

PRINTER RUSH
(PTO ASSISTANCE)

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REV 10/04

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FAX TRANSMISSION**DATE:** February 27, 2006**PTO IDENTIFIER:** Application Number 09/646741-Conf. #5912
Patent Number**Inventor:** Dickory Rudduck**MESSAGE TO:** US Patent and Trademark Office - Publishing Division**FAX NUMBER:** (571) 273-9009**FROM:** WILMER CUTLER PICKERING HALE AND DORR LLP

Laura A. Paquette

PHONE: (212) 230-8800**Attorney Dkt. #:** 112427.127 US1**PAGES (Including Cover Sheet):** 59**CONTENTS:**

Response to Notice to File Corrected Application Papers (2 pages)

A copy of Notice (1 page)

A copy of the Specification, Claims, Abstract and Figures as filed on September 18, 2000 (54 pages)

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399 Park Avenue, New York, New York 10022
Telephone: (212) 230-8800 Facsimile: (212) 230-8888

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| In re Application of | : | |
| Dickory Rudduck | : | Confirmation No.: 5912 |
| Serial No.: 09/646,741 | : | Allowance Date: December 29, 2005 |
| Filed: September 18, 2000 | : | Examiner: Kenneth L. Thompson |
| For: FIXING AND RELEASE SYSTEMS | : | |

**RESPONSE TO NOTICE TO FILE
CORRECTED APPLICATION PAPERS**

Honorable Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notice to File Corrected Application Papers dated February 3, 2006, submitted herewith are the following documents for filing in the above-referenced application:

1. Copy of the Notice to File Corrected Application Papers – 1 page;
2. Replacement copy of the Specification filed on September 18, 2000 – 28 Pages;
3. Replacement copy of the Abstract filed on September 18, 2000 – 1 Page; and
4. Replacement copy of the Drawings filed on September 18, 2000 – 25 Pages.

Application No.: 09/646,741

Docket No.: 112427.127 US1

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 08-0219.

Respectfully submitted,

Dated: February 27, 2006

By *LA Paquette*
Laura A. Paquette
Registration No.: 48,446
WILMER CUTLER PICKERING HALE
AND DORR LLP
399 Park Avenue
New York, New York 10022
(212) 230-8800
Agent for Applicant

**UNITED STATES PATENT AND TRADEMARK OFFICE**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Serial Number
09646741

Date Mailed
2/3/06

NOTICE TO FILE CORRECTED APPLICATION PAPERS***Notice of Allowance Mailed***

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given 30 days from the mail date of this Notice within which to correct the informalities indicated below. A failure to reply will result in the application being ABANDONED. This period for reply is NOT extendable under 37 CFR 1.136 (a) or (b).

- ♦ Specification- There are lines going through every page of specification for this application. Fax missing information to number below or e-mail.
- o For status updates visit <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR System, contact the Electronic Business Center (EBC) toll free at 866-217-9197.

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Tajuanna Mills for Rori Burch
USPTO
Publishing Division
Rori.burch@uspto.gov
Fax (571) 273-9009
Fax (703) 308-6642
703-305-0333 ext.135 (V)

FIXING AND RELEASE SYSTEMS

TECHNICAL FIELD

This invention lies in the field of fixing and/or release systems for a myriad of products and applications. This invention also relates to connectors for use in
5 fixing and release systems.

BACKGROUND ART

The need to fix one element to another, such as a panel to a stud, has given rise to a large technology relating to fasteners. Primitive versions, such as nails and screws, are labour intensive and have the drawback that the fixing means are
10 visible externally. It is desirable to fix one element to another so that the fixing means are not visible externally. This desirability may be based on aesthetic or economic reasons. For some applications, it may be desirable that the fixing means are not visible externally, for security purposes.

Common construction practice is to provide a first fixing stage, followed by a "final
15 fix" stage. This is labour intensive and generally results in post-finishing. It is desirable to eliminate the need for the first fixing stage and to fix only after assembly has been completed.

Further, common methods of fixing are rarely reversible without damage to the elements being fixed. It is desirable to devise a fixing system which, at least in
20 some aspects, is reversible without damage.

Still further, it is common to fix one element to another by the use of connectors which are separate from the first and second elements. It is desirable to incorporate at least part of a connector in a first or second element.

DISCLOSURE OF THE INVENTION

25 In one aspect, this invention relates to a system of fixing one element to another using remote means. In another aspect, this invention relates to a system which enables the remote fixing and remote release of elements. In still another aspect, this invention relates to a system which can provide information as to the status of the relationship between elements, for example whether they are fixed or not and
30 whether they have been released or not. In some forms, this invention relates to

fixing or release in a sequential manner between elements. Other aspects will also be disclosed in the following description.

It will be appreciated that, in some fields, remote fixing and release is a precursor to self-assembly.

- 5 The systems of this invention have particular application to the building industry. However, the invention is not limited to this area and has application in many other arts. For the sake of convenience, in many cases the description below will relate to the building industry.

- 10 Accordingly, in one aspect, this invention provides a method of fixing or releasing a first element and a second element, including the step of applying remote activation means to fix the first element to the second element or to release the first element from the second element.

Preferably, the fixing and/or the release can be effected without marking or damaging the first and second elements.

- 15 In the systems of the invention, there may be more than two elements which are fixed or released. For example, one first element may be fixed to or released from a plurality of second elements; a plurality of first elements may be fixed to or released from a single second element; or a plurality of first elements may be fixed to or released from a plurality of second elements. Further, where there is a
20 plurality of elements, these need not be identical. A plurality of first elements may differ from one another; a plurality of second elements may differ from one another.

The remote fixing or release means may be any suitable means and many of these will be apparent to persons skilled in the various relevant arts. Non-limiting
25 examples of remote fixing and release means are set out below.

The remote fixing means may provide the force or message required to activate fixing or release of the elements. Examples are the use of magnetic attraction or repulsion, the use of high frequency heating or radio frequency heating, the transmission of a message via a radio or other waves and so on.

- 30 In its simplest forms, the systems of the invention may cause the pushing of two elements together, or the locking of those elements, or the pushing of those two elements apart, or the unlocking of those elements. In this regard, there may be a

connecting means which can be regarded as "obedient" to the force or message generated by the remote fixing means.

In more sophisticated versions of the systems of the invention, the message can convey instructions (eg. digitally) which will enable the elements to move towards one another or apart from one another, or a connector between them to open or close. In particular, the message may cause movement in any or all of three dimensions. Thus, for example, a first element may be caused to move, relatively to the second element, longitudinally or laterally. A first element may be caused to rotate relatively to a second element.

10 In yet more sophisticated versions of the systems of the invention, it may be possible not only to transfer messages, but also to receive reports. For example, it may be possible to receive a report as to whether two elements are in a fixed state or in a released state, or whether the connection between them has been damaged or is stressed, for example because of movement as result of an
15 earthquake or because of tampering, such as an attempt to gain access to an electrical duct.

Further, encryption may be included in the systems of the invention, to incorporate security. This can be useful, for example, where it is desired to restrict access to elements or to objects or material for which the elements provide a
20 barrier. One example is the fixing of airplane parts, where access to part inspection, removal or replacement is to be restricted to authorised persons. The incorporation of encryption into the systems of the invention can require an appropriately coded activation means in order to permit fixing or release of the elements.

25 These last-mentioned examples of the systems of the invention can be regarded as "intelligent obedient" versions, since not only is there response to a message or force provided by the remote means, but also feedback can be obtained as to state of the fixing or release and access can be restricted in an appropriate manner. Further, this version can prevent access without appropriate
30 authorisation and can provide a record of the time of fixing or release. Thus, for example, unauthorised access to a petrol or gas pump may be prevented and the time of use of the pump by authorised users can be recorded.

In one version of the "intelligent obedient" systems of the invention, a report can be obtained as to the location of the fixing or release mechanism.

Another advantage which the "intelligent obedient" systems of the invention can have is to prevent unauthorised release after assembly (of the elements) has been completed.

The ability of the systems of the invention, in one form, to move one element
5 relative to the other, in any of three dimensions, provides an enormous boost to the problems encountered in the building industry, where wall height, for example, can vary by 50 to 60 millimetres; the present invention, in some aspects, makes it possible to effect required adjustments on site. This permits tolerance, for example, vertically, and gives the capacity to deal with orthogonal movement.

10 It will be appreciated that, in those versions of the systems of the invention which enable release of the elements, the invention provides a ready means for dismantling buildings or parts of buildings without the need for demolition and with the ability to preserve building elements for re-use.

Further, especially in the "intelligent obedient" form, it is possible to effect fixing or
15 release of the elements in a set sequence. This can be useful, for example, when fixing a large panel to studs. It may be desired to fix the top and bottom corners first to ensure correct alignment and follow by fixing in other areas. In one version of the systems of the invention, the fixing of the four corners of the panel will activate in sequence the fixing at the subsidiary locations.

20 As has been stated above, this invention is not limited to application in the building industry. There are numerous other areas in which remote activation of a fixing or release of two elements relative to one another is desired. By way of example only, the following are mentioned. Where it is desired to maintain a sterile environment, such as in the packaging of blood, for example, the valve
25 inside the packaging may be activated remotely in order to release the blood, in accordance with the blood. The activation may be carried out by applying a magnetic force, for example, to a disc in the valve which may be rotated or otherwise moved within the valve. It will be appreciated that sterility can be maintained in these circumstances.

30 The fixing and release system of the invention can be used to connect two pipes or conduits in a sterile manner, for example.

As another example, remote activation of fixing or release can be useful in the food industry, where the introduction of contamination is to be minimised.

The fixing or release of one element relative to the other may be effected using a connecting means separate from the elements or by using connecting means which are incorporated in the first or second elements, or both. This latter aspect may be regarded as part of "on board technology", which is discussed further, 5 below.

In another aspect, this invention provides a connecting means adapted to fix or release a first element and a second element, the connecting means including a locking means movable by remote activation means between a locked position and an unlocked position.

- 10 As non-limiting examples of connecting means which are separate from the first and second elements, there may be mentioned the following.

A fastener having two parts, one being a female part which can be attached to one element during or after manufacture and the other being a male part attached to the second element during or after manufacture can be aligned so that the 15 male part is received within the female part, following which locking of the male part to the female part is effected by remote means.

As another example, glue or adhesive which is cured by RF heating may be inserted at appropriate locations between the first and second element, after which the glue is cured by the application of RF heating and the elements are 20 fixed one to the other. It will be appreciated that in this embodiment it may not be possible to release the elements subsequently.

As a further example, one element may be joined to another element in a spaced manner by elongated joiners, for example, for the purpose of inserting cabling between the elements. The joiners can then be activated by suitable means so 25 that they collapse, allowing the elements to be fixed as closely to each other as the cabling or other material will allow.

As an example of "on board technology", which is discussed in further detail below, one element may have protrusions, while the other element may have recesses or pits adapted to receive the protrusions, so that after remote 30 activation, one element is fixed to the other and optionally can be released from the other after further activation.

The remote fixing or release system of the invention has a very wide field of application, indeed. Some of these will now be mentioned. It is to be understood that these are in no way limiting on the scope of the invention.

When a power cable connected to a power plug is plugged into a power socket, 5 the plug may be removed whether or not the power is switched on. This can have safety ramifications. By using the remote fixing and release system of the invention, it is possible to lock the power plug into the socket when the power is switched on. For example, the power plug may include a locking element and the power socket may include a receiving element. Activation of the "power on" switch 10 can not only cause current to flow through the power cable but, in accordance with the invention, can also fix the locking element to the receiving element, thus preventing withdrawal of the plug from the socket for as long as the "power on" switch is activated. When the "power on" switch is turned off, not only will electricity cease to flow but also the locking element will be released from the 15 receiving element and the power plug can be withdrawn from the socket.

In many situations, signs need to be enclosed in a tamper-proof covering. For example, bus timetables which need to be displayed at bus stops are best inserted beneath glass or perspex. Using the remote fixing and release system of the invention, it will be possible to use connectors to connect glass or perspex to 20 a backing board. The connectors are activated by remote activation means, such as by a radio signal. Thus timetables and other information may be changed or updated by authorised personnel using approved equipment.

The remote fixing and release system of the invention may also be used to provide security. For example, a computer may be programmed so that it can be 25 released from a cable only after a password has been accepted. For example, the cable may be inserted in the relevant port on the computer to connect power. As soon as the power is connected, the cable plug is fixed within the port and cannot be removed until a series of steps (referred to below) are taken. The fixing of the cable plug to the port may be effected in the following way, as an illustration. The 30 cable plug has (separately from the pins or cavities mating with the port on the computer) a pair of deformable plugs, each of which has a central cylindrical cavity. Each plug fits into a cavity provided near the computer port. As soon as the power is turned on, a pin is caused to enter the cylindrical cavity in the plug and locks the plug into the cavity. The person using the computer logs on and 35 performs the desired tasks. When it is desired to log off, the usual procedures are followed but, before the cable can be disconnected from the computer, it is

necessary to enter a password to reverse the locking procedure and release the cable. The computer can then be shut down.

Using the system of the invention, cables for computer equipment and mobile telephones, for example, can act as security devices, preventing unauthorised
5 removal of the computer equipment or telephones.

The system of the invention can have application in relation to security of other items, for example television receivers, video recorders and sound systems. Using radio frequency, for example, as the remote activation means, such valuable items may be fixed to larger items of furniture or to walls, floors or
10 ceilings. These valuable items may be fixed individually or in a specific order, thus immobilising them. When it is desired to move furniture or any of the valuable items, activation of the radio frequency device will release the locks.

Similarly, the remote fixing and release system of the invention can provide security when travelling. As an example, saddle bags can be connected to racks
15 on bicycles and released as desired using remote activation means in accordance with the invention.

In the case of valuable equipment such as photographic equipment, the camera can be releasably fastened to a tripod. The lens and lens cap can also be locked onto the camera, all to be removed only after use of correct access codes.

20 It will be readily appreciated that the remote fixing and release system of the present invention can provide security for artwork, without the need for unsightly locks, cables or similar means. Casings on burglar alarms may be made secure, with access only by authorised means.

In the case of automotive accessories and trims, such as spoilers, driving lights,
25 roof racks, air covers, components, radios, cassette decks, CD players, wheel nuts and so on, fixing and release may be effected using the system of the invention, providing convenient fixing in the first place and security thereafter.

Locking and release of vehicle doors can be effected remotely, for example by having a connecting element surround the perimeter of the door and being fixable
30 to a complementary element around the door cavity.

Access to black box recording devices in aircraft may be restricted as a security means, using the remote fixing and release system of the invention. There are

many applications where the remote fixing or release system of the invention can effect fixing in a more efficient and aesthetically acceptable manner than at present. For example, using the system of the invention it is possible to temporarily sound proof a room. For instance, a frame can be applied to the walls and ceilings of the room. Sound proofing panels can then be fixed to those frames using remote activation means. Because no fixing through the panels is required, sound proofing is more complete. When the room is no longer required to be sound proofed, the panels can be released from the frames, using the remote activation means.

- 10 As another example, the erection of billboards is possible using hidden fixing according to the system of the invention. In this way, it is possible to dispense with the use of messy adhesives and to overcome the problem of misalignment.

Items may become multifunctional with the effectiveness of the system of the invention in fixing one element to another until it is desired to release it. For example, it is contemplated that one can provide a multi-purpose boot with a sole which can be removed using remote activation means. A sole suitable for hiking may be attached when that activity is to be undertaken. The same boot may be used for football or similar sporting activities by substitution of a different sole. The boot may be fixed to a ski, for skiing, and so forth.

- 20 In public toilets there is a problem with maintaining a sufficient supply of paper towels and toilet paper while protecting such consumables against theft and damage. While at present these are usually dispensed from a locked dispenser, it is not possible to protect against unauthorised tampering with the dispenser, since the locking screws or the like need to be accessible. Because the remote fixing and release system of the invention allows the fixing means to be hidden and not accessible without the use of authorised means, this problem can be overcome according to the present invention. A toilet roll or paper dispenser may be locked onto a wall or other mount, with the locking means being hidden under the dispenser and locked or released by the remote activation means.

- 30 The system of the invention can be used to fasten carpets or rugs onto floors, to substitute for combination dial locks on luggage and other cases, to fix Christmas decorations on buildings and other structures. The system of the invention can be used to prevent access to dangerous items by children, such as to medicine cabinets and through pool fences. Access to coins collected in coin operated

machines can be restricted to those having authorisation using the system of the invention.

Braces, dentures and false teeth generally may be fixed in position using the system of the invention and released when required.

- 5 Shop fittings may be constructed in a desired manner and rearranged later using the system of the invention.

Fire extinguishers may be locked into position to prevent theft, but releasable by authorised means, or the sounding of an alarm.

- 10 Fire arms may be stored securely using the system of the invention, preventing unauthorised use.

Shipping crates may be locked using the system of the invention so that drugs or other illegal goods cannot be deposited in them.

Prosthetic joints may be installed with increased mobility and greater efficiency of joints using the system of the invention.

- 15 A dog collar may be joined around the neck of a dog using the system of the invention and released when required. The dog collar may include an electronic locating device, together with registration and owner details, all stored electronically.

- 20 Furniture and building components may be quickly and easily assembled and disassembled.

Batteries and access cards on mobile phones may be locked into position to discourage theft, using the system of the invention.

Cladding on buildings may be installed quickly, but also easily removed for renovations or repair using the system of the invention.

- 25 Appliances may have access panels fixed by using the system of the invention, to prevent unauthorised access and enable enforcement of warranties.

In the case of tools, interchangeable tool bits may be locked into position using the system of the invention and released when desired, as can accessories for kitchen appliances, for example.

Peripherals on computers, such as the mouse, an external disk drive, an external CD ROM, etc. can be secured to a computer by using the system of the invention, with a security code being required to release the peripherals, in a manner similar to that described above in connection with computer cabling.

- 5 Street furniture may be secured to surrounding structures by using the system of the invention, providing security while in situ and enabling easy removal for maintenance or repair.

Buildings, including domestic dwellings, can have all external entrances, windows, power supply and utilities locked off using the system of the invention.

- 10 The remote activation means may comprise a coded key or radio frequency activation, for example. Activation may occur as a result of a signal from a mobile telephone, as another example.

Turning now to "on board technology", this invention also provides an element which is intended for connection with a second element, the first element

- 15 incorporating first means to facilitate connection of the first element with the second element. Preferably, the first means are adapted to co-operate with second means incorporated on the second element to connect the first element with the second element. The technology is preferably incorporated at the point of manufacture and may eliminate or greatly reduce the finishing or re-finishing of
20 the element.

Broadly, "on board technology" principles can be applied to the areas of fitting, fixing and finishing. In relation to the areas of fixing and fitting, an element such as a panel, for example, may be provided with means for fitting the panel to a stud, for example. An instance of this is the insertion of a longitudinal groove
25 down one edge of a panel, into which may be received a clipping member, which in turn can fit the panel to the stud. Likewise, the panel may incorporate a longitudinal tongue which can connect directly to the stud or to a groove in a clipping member which can then connect to the stud.

As an example of the fixing aspect, reference is made to the example given
30 above in relation to the elements having protrusions or recesses which can cooperate with corresponding recesses or protrusions on other elements. These may be arranged on a face of each element, so that the elements can be fixed face to face. These may also be arranged in other locations on the elements, such as along the edges.

The "on board technology" may include grooves, pits, ribs, lumps, recesses or protrusions and these may be continuous or isolated. As further examples, there may be textures or embossing or undercut grooves or recesses on panels, for the purpose of adding a texture to one or more faces of panels, in order to provide traction during fixing, or to provide a decorative finish.

In relation to finishing, "on board technology" may provide elements with a selected finish, such as a decorative finish, textured or not, which can obviate the need for further treatment of the element after building or other assembly has been completed. Thus, for example, there may be no need to paint the element after assembly or building.

It will be readily appreciated by those skilled in the art that "on board technology" enables the manufacturer of the elements to build in added value to the elements, and increase the profit of the manufacturer, since a higher price may be charged for the elements with "on board technology", because subsequent treatment may be reduced.

It will be readily appreciated that "on board technology" may be used together with the fixing and release systems of the invention, or independently.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention in its various aspects will now be described with reference to certain drawings thereof, in which:

Figure 1 is a perspective view, partly broken away, showing alignment of a first element with a second element before application of remote activation means to fix the first element to the second element;

Figure 2 is an enlarged view of the elements of Figure 1 after the first element has been fixed to the second element by the application of remote activation means to a locking pin;

Figure 3 shows in exploded form an isometric view of connecting means;

Figure 4 shows in sectional view the connecting means of Figure 3 in situ between first and second elements;

Figure 5 shows in sectional view, in situ between first and second elements, another embodiment of the connecting means, while Figure 6 shows the same view on a scale of 1:1, to show actual size;

Figure 7 shows in side elevation a prior art canoe clip, used, for example, to
5 secure upholstery linings to vehicle doors, as well as many other applications;

Figure 8 shows in sectional view the lower part of a canoe clip modified to form a connecting means in accordance with the invention;

Figure 9 shows the interior of a vehicle door illustrating one use of the connecting means of Figure 8;

10 Figure 10 is a sectional view of another form of connecting means according to the invention, shown in situ between a first element and a second element;

Figure 11 shows the connecting means of Figure 10 in the locked position;

Figure 12 is a side view of a bolt and nut assembly;

Figure 13 is a sectional side view of the bolt and nut assembly of Figure 12,
15 showing the bolt inserted into the nut and locked;

Figure 14 is a sectional side view of the assembly of Figures 12 and 13, showing the bolt being inserted into the nut;

Figure 15 illustrates the bolt of Figures 12, 13 and 14, showing the lock pin in the "locked" position;

20 Figure 16 is the view of the bolt of Figure 15, showing the lock pin in the "unlocked" position;

Figure 17 is a sectional view of the bolt omitting the lock pin;

Figure 18 is a side view of the bolt;

Figure 19 is a sectional side view of a further embodiment of connecting means
25 according to the invention, being in a valve with a single flow aperture;

Figure 20 is an end view of the valve of Figure 19, showing the valve in the closed position;

Figure 21 is an end view of the valve of Figures 19 and 20, showing the valve in the open position;

Figure 22 is another version of a connecting means according to the invention in a valve having two flow holes;

- 5 Figure 23 is an end view of the valve in Figure 22, showing the valve in the closed position;

Figure 24 shows the valve of Figures 22 and 23 with the valve open;

Figure 25 shows in end view a linear connecting means according to the invention;

- 10 Figure 26 is a top view of the connecting means of Figure 25 showing a discrete locking pin;

Figure 27 is a sectional view of the connecting means of Figures 25 and 26;

Figure 28 is a top view of the connecting means of Figure 25 with a continuous locking strip;

- 15 Figure 29 is a sectional view of the connecting means of Figure 28;

Figure 30 is a side view of the connecting means of Figure 25 showing optional teeth for longitudinal adjustment;

Figure 31 is a plan view of part of the linear connecting means of Figure 25, with discrete locking pins as in Figures 26 and 27;

- 20 Figure 32 shows a version of the connecting means of Figure 31 with a radiused corner, showing how the connecting means can follow a flexible path;

- Figure 33 shows in sectional view a first element and a second element, being two pipes, which are fixed in accordance with the method of the invention. The connecting means can be a continuous connecting means being a double-sided version of that in Figure 25. The connecting means may have discrete locking pins or a continuous locking strip. The connecting means is shown in the locked position;
- 25

Figure 34 shows the connecting means of Figure 33 in partial cross-sectional view, in the discrete locking pin version;

Figure 35 shows the same connecting means of Figure 33, showing the continuous locking strip version;

Figure 36 is a sectional view of a linear connecting means according to the invention, in the "locked" position, the connecting means having discrete locking
5 pins;

Figure 37 is a sectional view of the linear connecting means of Figure 36, during installation, showing the "unlocked" position;

Figure 38 shows a detail of the attachment of the connecting means of Figures 36 and 37 to a first element, in a dovetail cavity;

10 Figure 39 shows an alternate means of attaching the connecting means of Figures 36 and 37 to a first element, being by way of adhesive on the surface of the first element;

Figure 40 is an isometric exploded view of a further embodiment of the connecting means according to the invention;

15 Figures 41 and 42 are isometric exploded views of a still further embodiment of the connecting means according to the invention;

Figure 43 shows a connecting means which is capable of adjusting the first and second elements in vertical and horizontal directions, allowing adjustability in three dimensions;

20 Figure 44 shows the connecting means of Figure 43 set up to fix a wall panel (first element) to a stud (second element);

Figure 45 illustrates the fixing of two panels (first element) to a stud (second element) by induction or RF heating;

Figure 46 shows a stud (first element) which can be fixed to a panel (second
25 element) in accordance with the invention. This stud can be moved vertically to accommodate height variations;

Figure 47 is a sectional view of the stud of Figure 46 taken along the lines A-A in Figure 46;

Figure 48 shows in partial perspective view an architrave and a jamb, each joined
30 to a panel according to the invention;

Figure 49 shows in perspective view an embodiment of part of a connecting means for the purpose of fixing the architrave and the jamb in Figure 48;

Figure 50 shows a top plan view of a first element fixed to a second element by an elongated joiner, being the connecting means;

5 Figure 51 is a detail of the joiners and elements of Figure 50;

Figure 52 shows the fixing of a first element, being a panel, to a second element, being a stud, via a connecting means, being a clip. This figure also illustrates the "on board technology" concept in relation to the panel;

Figure 53 shows a step in a method of manufacturing an element being a panel
10 having "on board technology". In this embodiment, nodules are being formed on the face of the panel;

Figure 54 shows a further step in the manufacture of the panel of Figure 53, illustrating how the panel is flipped through 180° so that the nodules may form under the influence of gravity;

15 Figure 55 shows in plan view the panel of Figure 54 with the nodules formed;

Figure 56 is a sectional view of the panel of Figure 55 taken along lines A-A in Figure 55;

Figure 57 shows in perspective view the panel of Figures 55 and 56.

Superimposed on this is a second version of the panel where the nodules stand
20 proud of two narrow faces (or edges) of the panel;

Figure 58 shows another embodiment of "on board technology", in two versions, the first where there are recessed pits on the face of the panel and the second where there are recessed pits on the narrow faces or edges of the panel;

Figure 59 shows two versions of further "on board technology", the first where
25 there are ribs standing proud of the face of a panel and the second where there is a rib standing proud of the edge of the panel;

Figure 60 shows two further versions of "on board technology" in relation to a panel, the first being recessed channels in the face of the panel and the second being a recessed channel along an edge of the panel;

Figure 61 shows a pressing detail being a step in the manufacture of a rib of the panel shown in Figure 59;

Figure 62 shows an edging detail for the rib of Figure 61;

Figure 63 illustrates in plan view a panel formed with the rib of Figure 62 along its face; and

Figure 64 is a sectional view of the panel of Figure 63, taken along the lines A-A of Figure 63.

BEST MODES FOR CARRYING OUT THE INVENTION

- 10 Referring first to Figure 1, locking pin 1 is injection moulded from a suitable plastic material and includes a metal strip 2. Locking pin 1 lies in recess 3 between first element 4 and second element 5. Recess 3 has a narrow end 6 which lies within element 5.

When a magnetic force is applied to locking pin 1, it is caused to move within
15 recess 3 as shown in Figure 2, so that leg 8 of locking pin 1 is pushed into narrow recess 6, in turn expanding wall 9 so that it locks into the recess 10 provided in element 5.

Locking pin 1 may be reversed, so that elements 4 and 5 may be released, by the use of magnetic force. Magnetic attraction may be applied for fixing elements 4
20 and 5 and magnetic repulsion for releasing them, or vice versa. Alternately, the same magnetic force may be applied on opposite sides - for example, on the side near element 4 for fixing and on the side near element 5 for releasing.

Turning now to Figure 3, the connecting means 7 illustrated includes a wall plug 11 which can be screw threaded into second element 5 (refer Figure 4) and a
25 cooperating member 12 which includes aerial 13, capacitor 14, switch 15 and encryption logic chip 16. Cooperating member 12 is able to act as a receiver/transmitter and is inserted in first element 4.

To fix first element 4 to second element 5, plug 11 inserted in element 5 is aligned with member 12 inserted in element 4. A message is sent, for example, via radio
30 waves, to aerial 13 in member 12 to activate switch 15 which in turn causes plug 17 to travel into cavity 18 in the direction of arrow B provided in wall plug 11. Element 4 is thus fixed to element 5.

Encryption logic chip 16 may be capable of providing a report as to whether the connection between element 4 and element 5 has been stressed, such as by an earthquake or tremor.

Alternately or in addition, the movement of plug 17 into cavity 18 may transmit a signal to other connecting means which may then be caused to activate. As indicated above, this can be useful in providing a predetermined sequence of fixing, so that a large panel may be fixed at the four corners first, followed by automatic activation of the other fixing points.

To release element 4 from element 5, a message can be sent via radio waves to aerial 13 in member 12 to activate switch 15 which will cause plug 17 to travel in the direction of arrow C. Plug 17 will be released from cavity 18 in plug 11 and element 4 can then be separated from element 5.

With reference now to Figures 5 and 6, connecting means 19 is designed to be activated by electro magnetic means. Connecting means 19 has a top plate 20 of aluminium and a back fixing plate 21. Base plate 22 is of aluminium. Part 23 is made of acrylic material and surrounds nylon clip 24. Part 25 is also acrylic. Connecting means 19 also includes windings 26, washer 27, pin 28, bobin 29 (Teflon - trade mark) and spring 30.

As can be seen from Figure 6, connecting means 19 in actual size is small and neat and eminently suitable for connecting a first element to a second element.

The canoe clip 31 in Figure 7 is a prior art clip with flexible arms 32 and 33 and a stud 34. As is well known in the art, canoe clip 31 is pushed into the desired cavity. Arms 32 and 33 compress to take up space 35 and once canoe clip 31 has been pushed sufficiently through the cavity so that arms 32 and 33 are no longer constrained, they spring out again to the configuration shown in Figure 7, thus retaining canoe clip 31 in place.

In the improvement to canoe clip 31 shown in Figure 8 according to the invention, connecting means 36 shows how, if cavity 37 contains a moveable locking pin 38, activatable by remote means according to the invention, once connecting means 36 has been pushed into position, like the prior art canoe clip 31, locking pin 38 can be moved between arms 32 and 33 to prevent them coming together. Thus, connecting means 36 will fix first and second elements (not shown) together, until locking pin 38 is released by remote activation means.

In Figure 9, vehicle door 39 has trim 40 connected to interior of vehicle door 39 by the connecting means of the invention 38, for example, in the region indicated by circle 41. Thus, by using the connecting means of the invention, it is possible to ensure that only factory - approved equipment is used in connection with
5 maintenance of a vehicle.

With reference now to Figures 10 and 11, connecting means 42 is based on the known "quarter turn" fastener. Connecting means 42 is shown in position between first element 4 and second element 5. As can be seen from Figures 10 and 11, connecting means 42 does not breach the face surface of element 4, so that
10 element 4 can present a completely blank face for aesthetic or security reasons. Connecting means 42 has a drive magnet 43 and a plunger 44, biased by spring 45. When plunger 44 is caused to press down against spring 45 and rotate, by magnetic or electromagnetic means, channel 46 engages rod 47 to hold
connecting means 42 in the locked position, thus connecting elements 4 and 5.
15 Elements 4 and 5 can be released by applying a remote activation means to rotate plunger 44 in the opposition direction, so that rod 47 is disengaged by channel 46.

Reference is now made to Figures 12 to 18. These Figures illustrate the application of the invention to the rapid assembly and disassembly of a bolt and
20 nut. Bolt 48 is shown inserted through a panel 49 with a washer 50 inserted between panel 49 and nut 51.

As shown in Figure 13, bolt 39 includes channel 52 in which, according to the invention, there is inserted lock pin 53. In the unlocked position, lock pin 53 reposes in head 54 of bolt 58 (refer Figures 14 and 16). In the locked position
25 (refer Figures 13 and 15), lock pin 53 has been caused to travel (by means of a magnet, lock pin 53 being metal) along channel 52, pushing the surrounding shank of bolt 48 outwardly so that external groove 56 engages nut 51. As will be appreciated by one skilled in the art, bolt 48 can be quickly disconnected from nut 51 by using magnetic means to retract lock pin 53 into head 54 of bolt 48.

30 With reference to Figure 19 to 21, connecting means 57 is a valve for controlling flow within conduit 58. Valve 57 had a metal disk, 59 and 60, each of which has a cut out portion 61 and 62 respectively. When cut out portion 61 is aligned with cut out portion 62, as in Figure 21, connecting means 57 represent the valve in the open position, allowing fluid to flow along conduit 58 through valve 57. When disk
35 59 is rotated relatively to disc 60, as shown in Figure 20, valve 57 is closed,

preventing flow of fluid along conduit 58 through valve 57. Disk 59 can be rotated to the open or closed position in valve 57 by the application of remote activation means. Thus, valve 57 can be opened or closed in a sterile environment. This can have importance in hospitals and other medical applications, for example. 5 Illustrated in Figures 19 to 21 is a magnetic locking ring 63 which causes disk 59 to rotate relatively to disk 60. It will be appreciated that valve 57 may be opened or closed by using means other than magnetic means.

With reference now to Figures 22 to 24, connecting means 64 represents a double-apertured valve in conduit 58. Disk 59 is caused to rotate relatively to disk 10 60 by rotation of locking ring 63, as in the previous example. When apertures 65 and 66 on disk 59 are aligned with apertures 67 and 68 on disk 60, fluid can flow through valve 64, similarly, the flow of fluid can be halted by rotating locking ring 63 so that apertures 65 and 66 are not in alignment with apertures 67 and 68.

The connecting means of the invention need not be discrete; it may be linear or of 15 indefinite length. This is illustrated by Figures 25 to 27.

Referring first to Figure 25, connecting means 70 is linear and of indefinite length, as indicated by the top view in Figure 26. Connecting means 70 has a base 71 and a channel 72 formed between channel sides 73 and 74. Channel sides 73 and 74 terminate in expanded portions 75 and 76 respectively, for locking into an 20 element when the locking means are activated. Connecting means 70 may have locking teeth 77 along some or all of its length. Locking teeth 77 may be incorporated on one or both of expanded portion 75 and 76. Locking teeth 77 can assist in longitudinal adjustment of one element relatively to another.

Connecting means 70 may have a plurality of discrete locking pins 78 (refer 25 Figures 26 and 27) or a continuous locking strip 79 (refer Figures 28 and 29). In either case, the locking pin 78 or the locking strip 79 is activated by remote means to move in channel 72 upwardly to repose between expanded portions 75 and 76, thus preventing them from being deformed inwardly when connecting means 70 is in the locked position.

30 Figure 31 shows an indefinite length of the connecting means 70 with discrete locking pins 78. Figure 32 shows the same connecting means 70 in a flexible form so that it can be shaped around corners or around the perimeter of objects, such as vehicle doors, for example.

The connecting means of the invention can be used to fix (and subsequently release) first and second elements being pipes or the like. With reference to Figure 33, connecting means 80 is formed as a double-sided version of linear connecting means 70, with a base 81 and channels 82 and 83, being coaxial, each formed between channel sides 84 and 85. As was the case with connecting means 70, each channel side terminates in expanded portions 86 and 87 which are designed to fit into a complementary cavity in pipe walls 88 and 89. Although connecting means 80 may have a continuous locking strip as in the embodiment in Figures 28 and 29, illustrated in Figure 33 are discrete locking pins 90.

- 10 Base 81 may provide an adequate seal between pipes 91 and 92. However, especially in the case where pipes 91 and 92 are intended to carry fluid, it is optional to include seals 93.

It will be appreciated that, using the connecting means of the invention, locking pins 90 may be locked between expanded portions 86 and 87 by remote activation means, thus securing pipes 91 and 92 together until it is desired to release them by use of the remote activation means.

Figure 34 shows the connecting means 80 following the circumference of pipes 91 and 92.

Figure 35 shows an alternate version of a connecting means 94, with a continuous locking strip 95 instead of discrete locking pins 90.

A linear connecting means, such as that illustrated in Figures 25 to 35, can operate as shown in the detail in Figures 36 and 37. In Figures 36 and 37, connecting means 96 has, in this case, a dovetail shaped base 97 and, once again, a channel 98 formed between channel sides 99 and 100. Each of channel sides 99 and 100 terminates in an expanded portion 101 and 102. When it is desired to fix first element 4 to second element 5 (refer Figure 37), connecting means 96 is inserted in a dovetail-shaped channel 103 in first element 4 and channel sides 99 and 100 are pressed into cavity 104 in second element 5.

Channel sides 99 and 100 are caused to deform inwardly by the constraints of the sides of cavity 104, until expanded portions 101 and 102 reach the expanded part 105 of cavity 104, when channel sides 99 and 100 spring out to their normal position. It is at this stage that locking pin 106 can be activated by remote means, such as magnetic means, to move along channel 98 until it rests between expanded portions 101 and 102. Thus, expanded portions 101 and 102 are

trapped within expanded part 105 of cavity 104, since channel sides 99 and 100 can no longer be deformed inwardly to release expanded portions 101 and 102. In this position, shown in Figure 36, first element 4 is fixed to second element 5. It will be readily appreciated that reversing the procedure will permit first element 4 to be released from second element 5, without damage or marking to either element.

Connecting means 96 is shown inserted in dovetail cavity 103 in element 4, in Figures 36 and 37 and also in Figure 38. An alternate arrangement is shown in Figure 39, where connecting means 107 has base 108, which is adhered or otherwise fixed to first element 4. Otherwise, connecting means 107 operates in the same way as connecting means 96.

In Figure 40 is illustrated a discrete connecting means 109 which has a base 110 (dovetailed in cross-section), a housing 111 for locking pin 112 and plunger 113 and a channel 114 formed between channel sides 115 and 116. Channel sides 115 and 114 terminate in expanded portions 117 and 118.

Base 110 can be inserted in dovetail shaped channel 119 in first element 4. When connecting first element 4 to second element 5, channel sides 115 and 116 are pushed into cavity 120, deforming inwardly to channel 114 and then springing apart again into expanded part 121 of cavity 120. Locking pin 112 can then be activated and pushed by plunger 113 so that it occupies channel 114 between channel sides 115 and 116 and prevents them deforming so as to restrict withdrawal from expanded part 121 of cavity 120.

The embodiments in Figures 41 and 42 of connecting means according to the invention are in essence a reversed form of the embodiment of connecting means 109 in Figure 40. In Figures 41 and 42, connecting means 122 have base 110 and housing 111 together with locking pin 112 and plunger 113 or plunger assembly 123. Part 124 of connecting means 122 has shank 125 which is intended to be fixed to second element 5 (not shown). Channel 114 formed by channel sides 115 and 116, together with expanded portions 117 and 118 enter housing 111 during fixing of element 4 to element 5. Locking pin 112 is then activated by remote means - for example, by a radio signal in the case of the embodiment in Figure 41 and by a magnet in the case of the embodiment in Figure 42, so that locking pin 112 moves between expanded portions 117 and 118 and locks element 4 to element 5.

With reference now to Figures 43 and 44, Figure 43 shows a connecting means 126 adapted to be fitted to a first element (wall panel 127) and to be fixed to a second element, stud 128. Connecting means 126 has three sets of ribs, 129, 130 and 131. Ribs 129 permit adjustment of connecting means 126 (and panel 127) to the left and right as shown by arrow 132. Ribs 130 provide for adjustment in the in/out direction as shown by arrow 133. Ribs 130 can lock into extruded locking ribs 134 on stud 128. Ribs 131 provide for up/down adjustment in the direction shown by arrow 135 and can mesh with knurled locking ribs 136 on stud 128. Thus, panel 127 can be adjusted in the desired position before activating means (not shown) fix connecting means 126 to stud 128.

In Figure 45, dogbone stud 137, made of metal, and forming the first element, is shown together with the second elements, panels 5 and 5a. Beads of glue 138 are inserted in channels provided in dogbone stud 137. Glue 138 is a hot melt glue which is cured by RF heating. Until such cure takes place, dogbone stud 137 and panels 5 and 5a are maintained in place by a magnetic force, as indicated by arrow 139.

Heat sufficient to melt glue 138 is applied by apparatus 140 which includes a rotating heated wheel which rotates in the direction indicated by arrows 141. Once glue 138 has been cured, the magnetic attraction holding dogbone stud 137 to panels 5 and 5a can be released.

In Figure 46, foam stud 142 is provided in a length shorter than the vertical height of the wall panel 143 to be mounted. For example, foam stud 142 may be 2 metres long whereas wall panel 143 may be 2.3 metres high. A suitable locking means, activatable remotely, is indicated at 144. Lock 144 could be activated by magnetic means, for example. Stud 142 includes a number of adjustment ribs 145, the profile of which can be seen in the section in Figure 47.

In Figure 48, the method of the invention is shown in use, in this embodiment connecting a first element - an architrave 146 or a jamb 147, to a second element, panel 148 or 149 respectively. As can be seen from Figure 48, architrave 146 and jamb 147 each incorporates a dovetail-shaped channel 150. This is for insertion of a connecting means 151 of the invention, as illustrated in Figure 49. Connecting means 151 can operate the same as connecting means 109 in Figure 40, for example.

It will be readily appreciated by one skilled in the art that cornices and other building elements may be substituted for the architrave 146 or the jamb 147 in Figure 48.

Turning now to Figures 50 and 51, first element 4 is joined to second element 5 by a plurality of elongated joiners 152.

As may be seen from the detail in Figure 51, elongated joiner 152 has bulbous ends 153 which fit into complementary cavities in elements 4 and 5. Bulbous ends 153 can rotate in these cavities. Elements 4 and 5 may be assembled with elongated joiners 152 in the positions shown in Figures 50 and 51, so that cabling or other material may be inserted between elements 4 and 5. Once that insertion has been completed, activation of remote means (not shown) can cause joiners 152 to collapse, or to rotate via their bulbous ends 153, bringing elements 4 and 5 together or bringing one of the elements towards the other, thus permitting the cabling or other material to lie between elements 4 and 5, while still minimising the gap between elements 4 and 5.

In Figure 52, panel 4 includes edge groove 154, which is an example of "on board technology". Into groove 154 is fitted extrusion 155 on connecting clip 156, which comprises an embodiment of connecting means according to the invention, to fix panel 4 to stud 5. Clip 156 has extruded arms 157 which snap fit into channel 158 of stud 5. Locking pin 159 in clip 156 may be activated after arms 157 have snapped into channel 158, so as to retain arms 157 in channel 158 until such time as release is required. Activation may be by magnetic or other suitable means.

Figure 53 shows an embodiment of manufacture of a panel with "on board technology", being a series of spaced nodules. This invention also includes within its scope a method of manufacture of such a panel. In the example shown, applicator 160 deposits small quantities of appropriate material 161 on a face of panel 5, as panel 5 travels in the direction of arrow 162.

Panel 5 is then inverted as shown by arrows 163 (Figure 54), so that material 161, owing to its qualities, develops into nodules 164, under the influence of gravity. These nodules may set without any further treatment, or may require curing, such as by heat. The finished product is shown in Figures 55 and 56.

Figures 57 and 58 show how "on board technology" may be incorporated into panel 5, either on a face 167 or an edge 168 thereof, in the form of recessed pits 165 (Figure 58) or proud nodules 166 (Figure 57).

Similarly, Figures 59 and 60 show how panel 5 can incorporate "on board technology", in the form of proud ribs 169 (Figure 59) or recessed channels 170 (Figure 60).

The manufacture of ribs 169 on panel 5 is detailed in Figures 61 and 62, with a plan view shown in Figure 63 and a sectional view shown in Figure 64. First, ribs 169 are formed as shown in Figure 61, using pressing means 172, with the locking portion 171 formed as shown in Figure 62, using edging means 173. The finished product is shown in Figures 63 and 64.

INDUSTRIAL APPLICABILITY

- 10 As will be readily appreciated by those skilled in the various arts, the inventions disclosed herein are not limited to the examples set out and have wide applications in many areas. These inventions represent significant advances in the relevant arts.

CLAIMS

1. A method of fixing or releasing a first element and a second element, including the step of applying remote activation means to fix the first element to the second element or to release the first element from the second element.
5
2. The method of claim 1, wherein the first element is aligned with the second element before the remote activating means is applied to fix the first element to the second element.
3. The method of claim 1, wherein the first element is fixed to or released from the second element without marking or damaging either element.
10
4. The method of claim 1, wherein the first element is fixed to or released from more than one second element.
5. The method of claim 1, wherein the second element is fixed to or released from more than one first element.
- 15 6. The method of claim 1, wherein a plurality of first elements is fixed to or released from a plurality of second elements.
7. The method of claim 4 or 6, wherein the second elements are not identical.
8. The method of claim 5 or 7, wherein the first elements are not identical.
9. The method of claim 1, wherein the fixing or release of the first element and the second element is effected via one or more connecting means between the first element and the second element.
20
10. The method of claim 9, wherein a female connector is attached to the first element and a male connector adapted to cooperate with the female connector is attached to the second element.
- 25 11. The method of claim 9, wherein the first element is fixed to the second element via a connector being adhesive curable by radio frequency heating and the remote activation means comprises radio frequency heating means.

12. A method of adjusting a first element relatively to a second element, including the step of:
- (i) fixing the first element to the second element via one or more connecting means between the first element and the second element resulting in a space between the first element and the second element; and
 - (ii) Applying remote activation means to cause the or each connecting means to reduce the space between the first and second elements.
13. A method of fixing or releasing a first element and a second element, substantially as herein described with reference to any one of figures 1 to 52.
14. A connecting means adapted to fix or release a first element and a second element, the connecting means including a locking means moveable by remote activation means between a locked position and an unlocked position.
15. The connecting means of claim 14, wherein the locking means is a locking pin disposed in a channel with a base and deformable sides and the locking pin is adapted to be moved within the channel by the remote activation means towards or away from the base.
16. The connecting means of claim 14, wherein the locking means is rotatable between a locked position and an unlocked position.
17. The connecting means of claim 15, wherein the locking pin, the channel and the base are of indefinite length.
18. The connecting means of claim 15, wherein there are two locking pins, each disposed in a channel with a base and deformable sides.
19. The connecting means of claim 17 or 18, wherein the connecting means is flexible.
20. The connecting means of claim 14 wherein the connecting means provides for adjustment of the first element relatively to the second element in one, two or three dimensions.

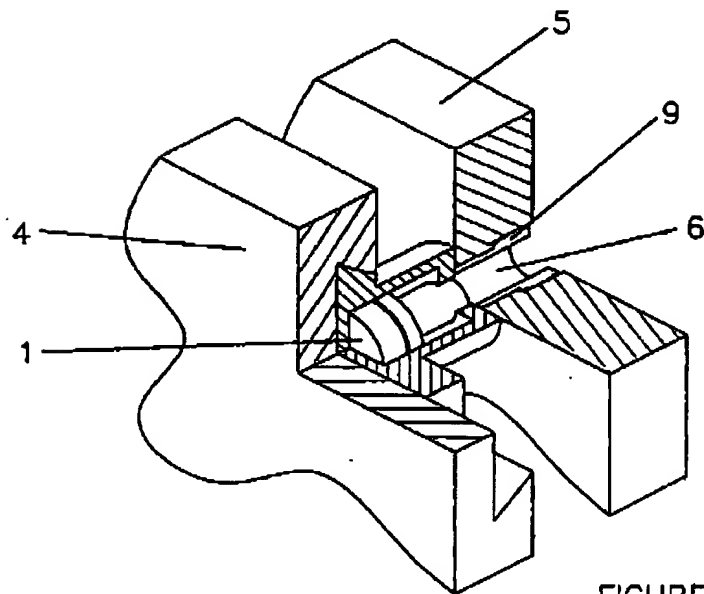
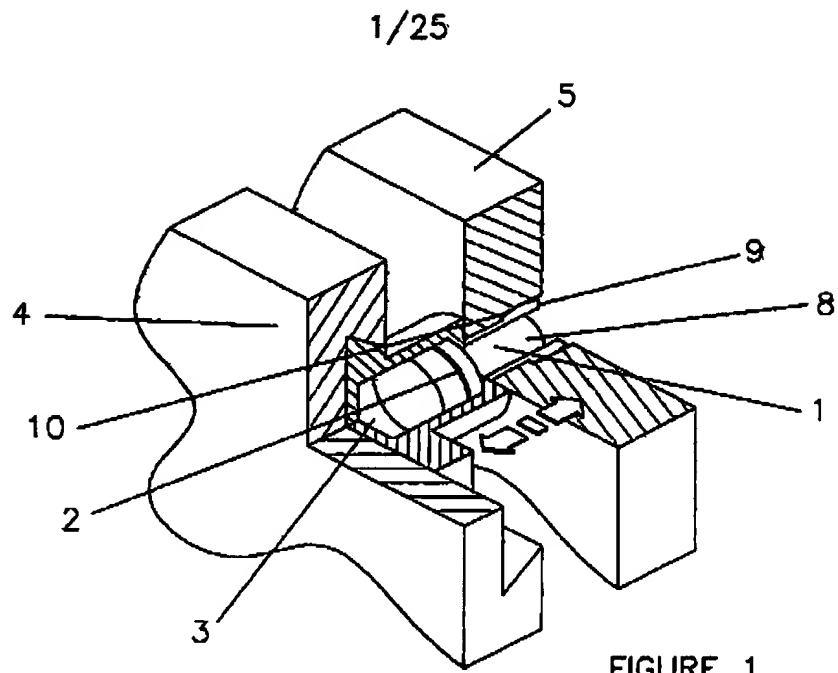
21. The connection means of claim 14 substantially as herein described with reference to any one of figures 1 to 44 or 46 to 52.
22. An element which is intended for connection with a second element, the first element incorporating first means to facilitate connection of the first element
5 with the second element.
23. The element of claim 22, wherein the first means are adapted to cooperate with second means incorporated on the second element to connect the first element with the second element.
24. The element of claim 22, wherein the first means are adapted to cooperate
10 with a connecting means to connect the first element to the second element via the connecting means.
25. The element of claim 23, wherein the first means comprises a set of protrusions and a second means comprises a set of recesses adapted to receive the protrusions.
- 15 26. The element of claim 23, wherein the first means comprises a set of recesses and the second means comprises a set of protrusions adapted to be received in the recesses.
27. The element of claim 23, wherein the protrusions are located on a face of the first element and the recesses are located on a face of the second element.
- 20 28. The element of claim 25, wherein the recesses are located on a face of the first element and the protrusions are located on a face of the second element.
29. The element of claim 27 or 28, wherein the face of the first element and the face of the second element is an edge of the respective elements.
- 25 30. The element of claim 22 substantially as herein described with reference to any one of figures 53 to 64.
31. A method of manufacturing the element of claim 22, including the steps of
30 depositing discrete amounts of settable material on a surface of the element and rotating the element through 180° to permit the material to set under the influence of gravity.

32. The method of claim 31, wherein the material is further treated to effect setting.
33. The method of claim 22 substantially as herein described with reference to figures 53 and 54.

6

ABSTRACT

A connecting means adapted to fix or release a first element (4) and a second element (5) includes a locking pin (1) which is moveable by remote activation means between a locked position, in which leg (8) expands wall (9) into recess (10), and an unlocked position. The remote activation means may be magnetic, electro-magnetic or any other suitable means. A method of fixing or releasing first and second elements by remote activation means is also disclosed. The invention further provides a first element having first means (166) adapted to cooperate with second means (165) on a second element to facilitate connection of the first and second elements. A method of manufacturing the first element includes the steps of depositing discrete amounts of settable material on a surface of the first element and inverting the element to permit the material to set under the influence of gravity. A method of reducing the spacing between first and second elements by remote activation means is also disclosed.



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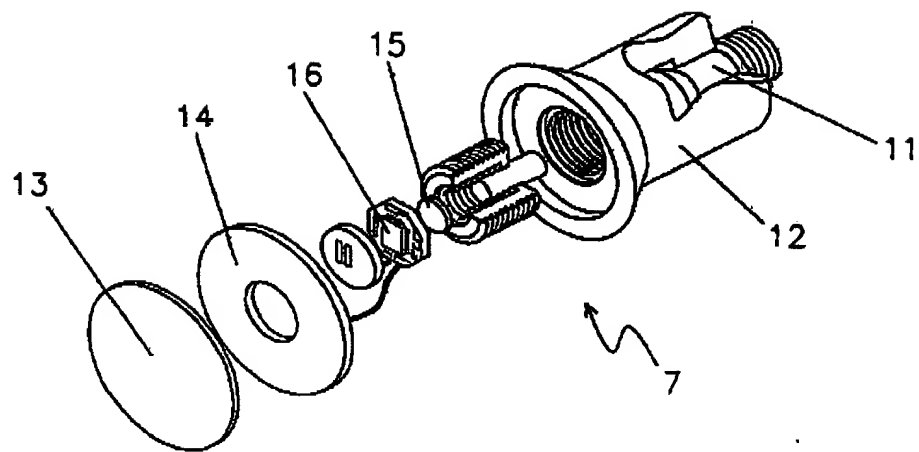


FIGURE 3

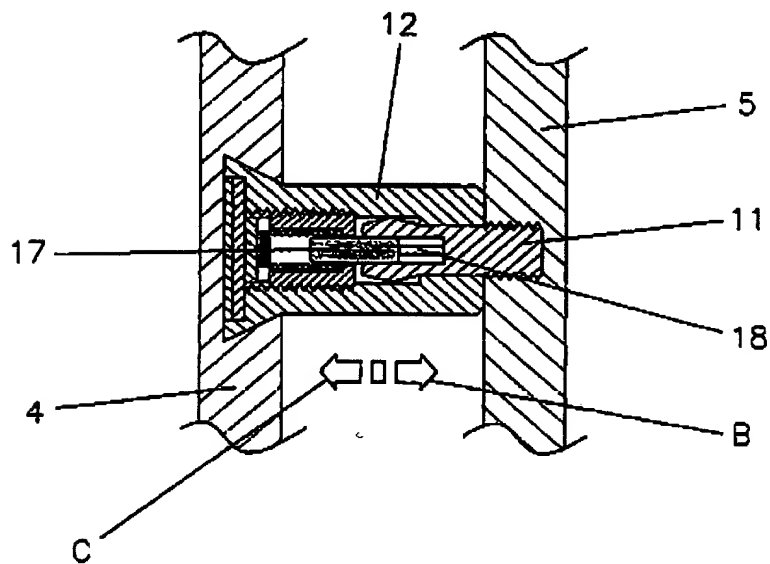
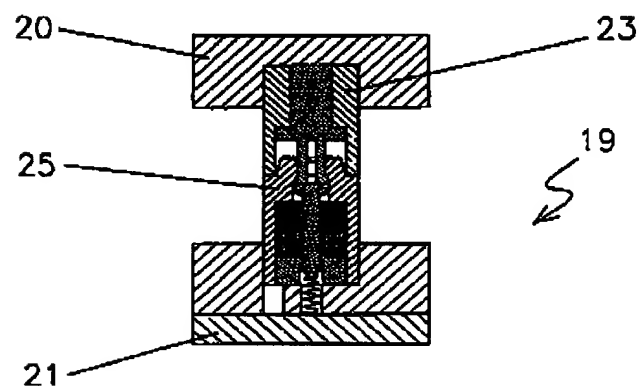
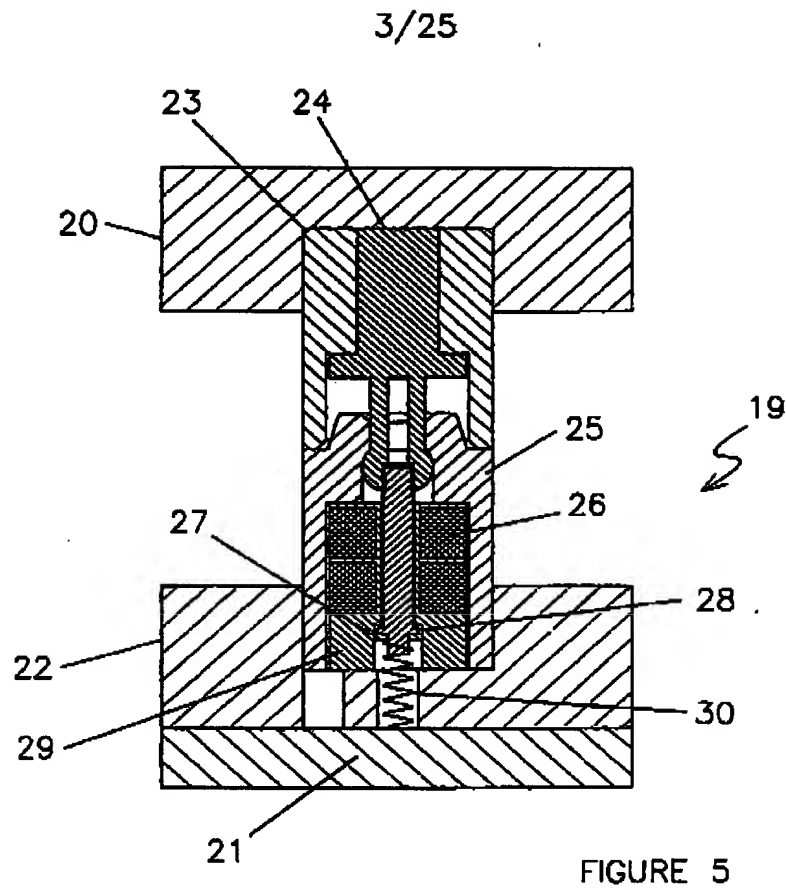


FIGURE 4



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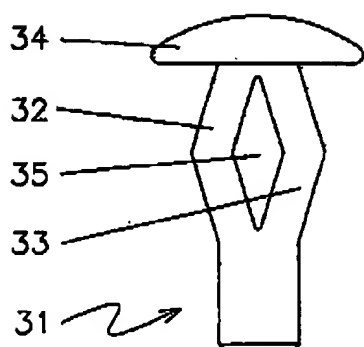


FIGURE 7

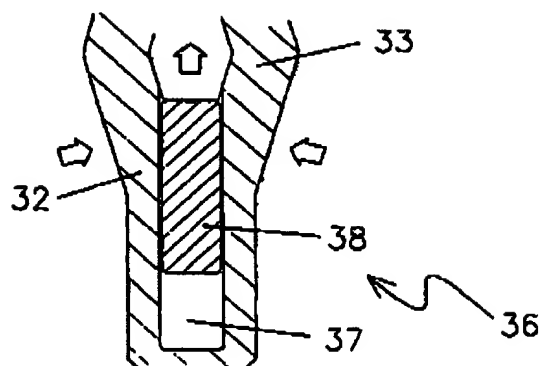


FIGURE 8

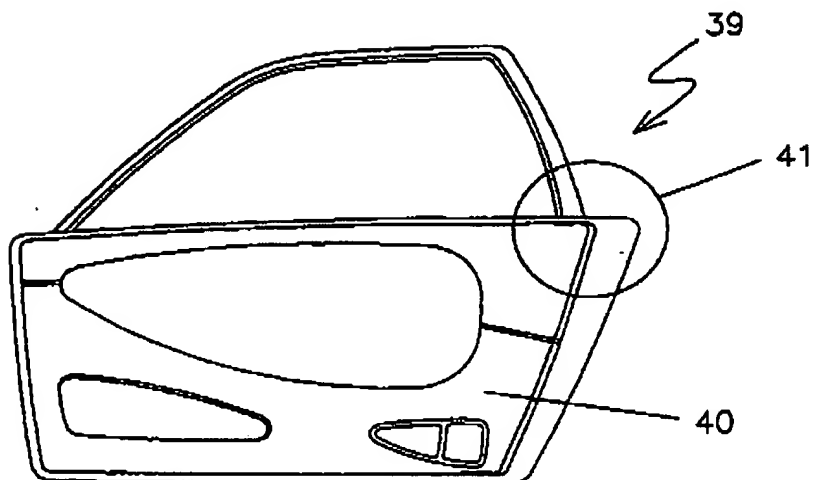


FIGURE 9

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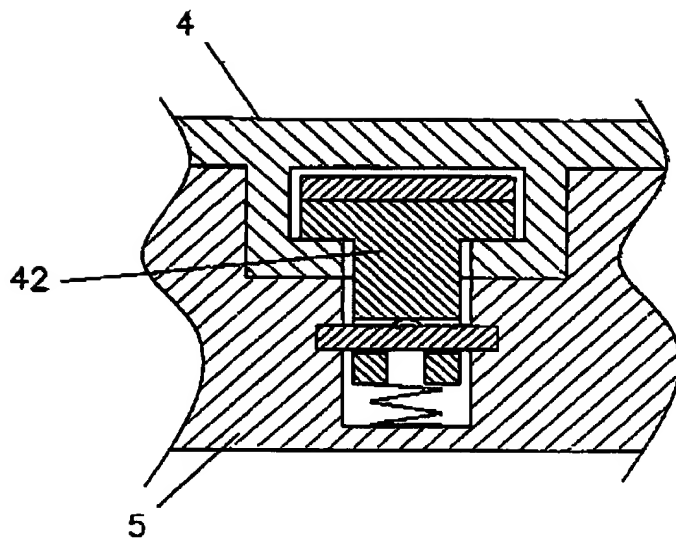


FIGURE 10

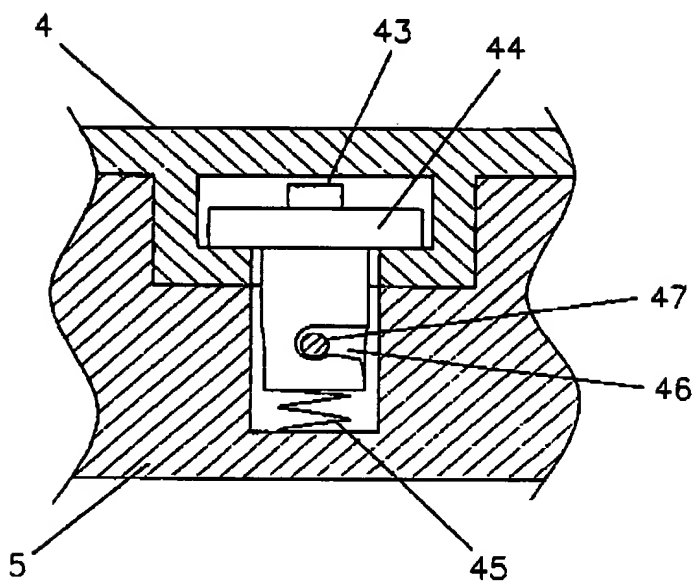


FIGURE 11

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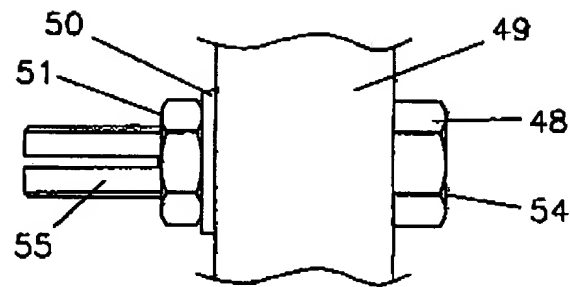


FIGURE 12

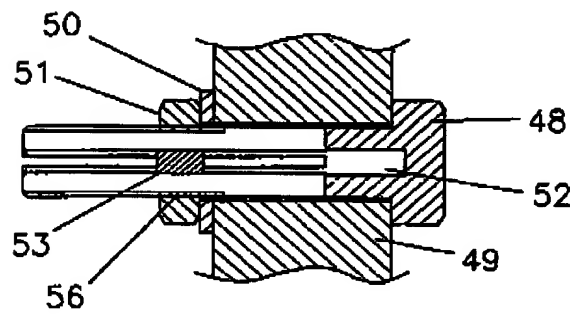


FIGURE 13

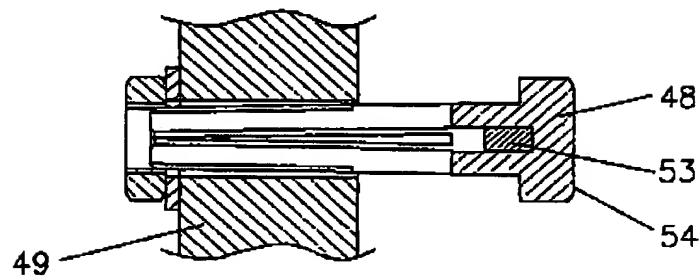


FIGURE 14

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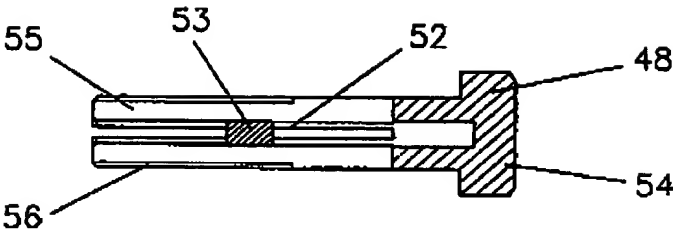


FIGURE 15

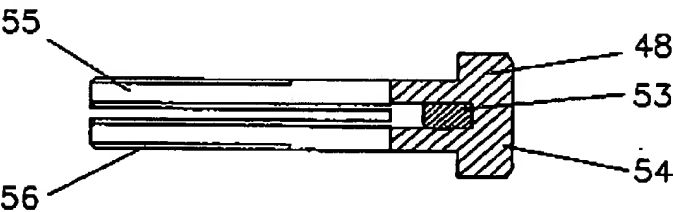


FIGURE 16

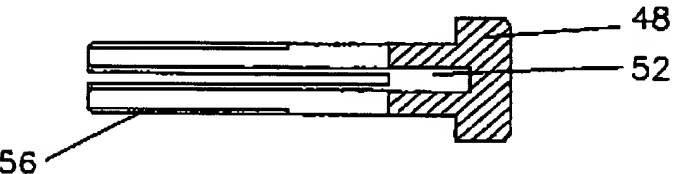


FIGURE 17

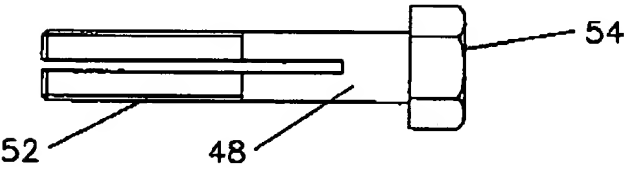


FIGURE 18

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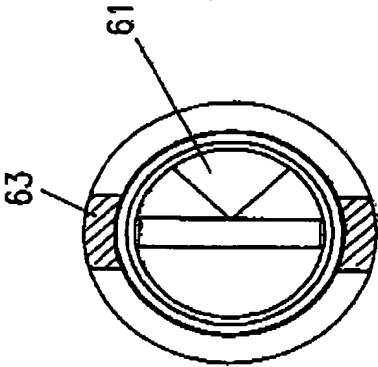


FIGURE 21

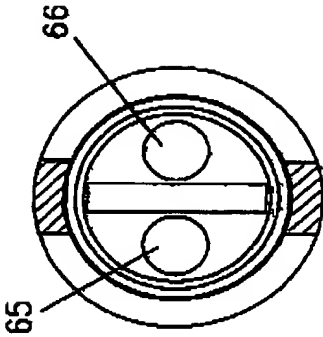


FIGURE 24

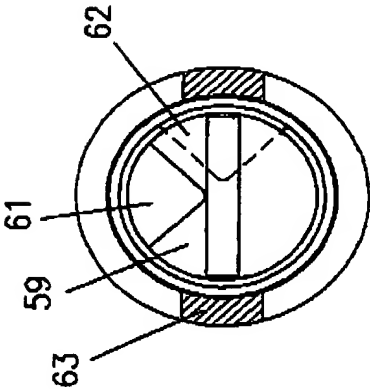


FIGURE 20

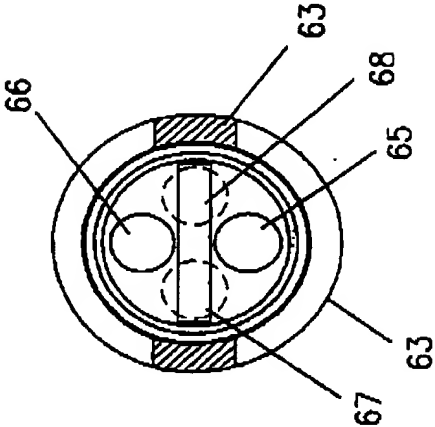


FIGURE 23

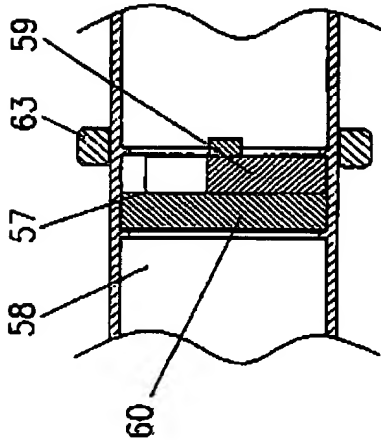


FIGURE 19

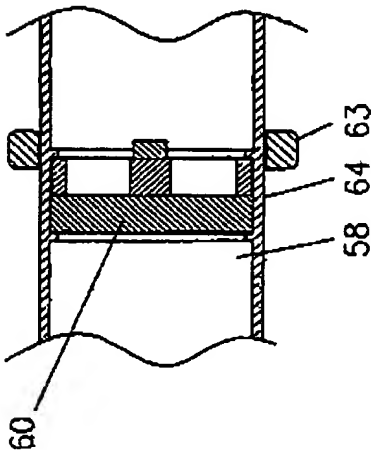


FIGURE 22

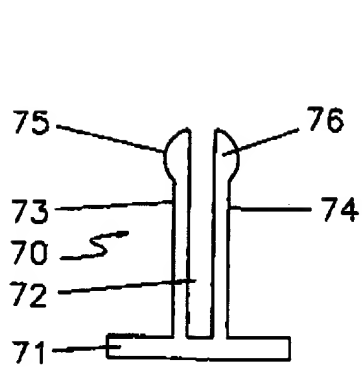


FIGURE 25

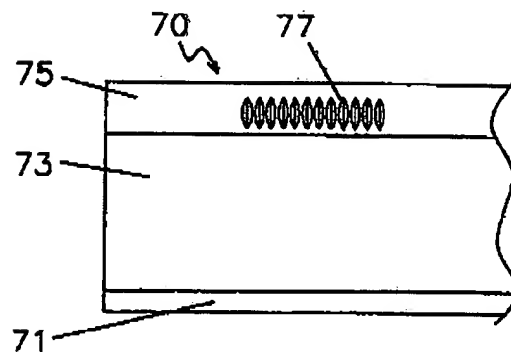


FIGURE 30

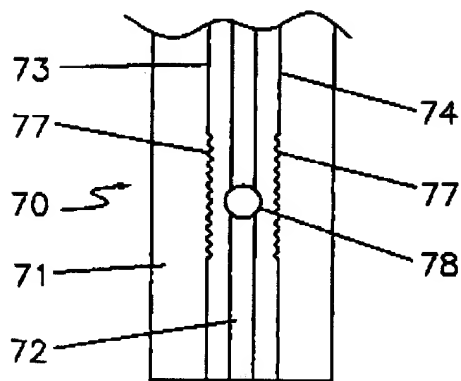


FIGURE 26

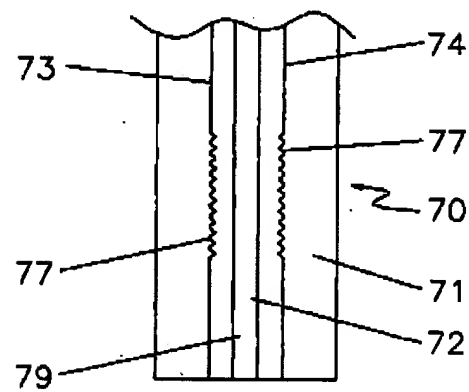


FIGURE 28

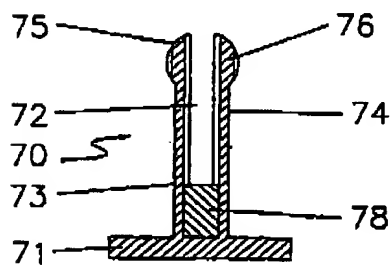


FIGURE 27

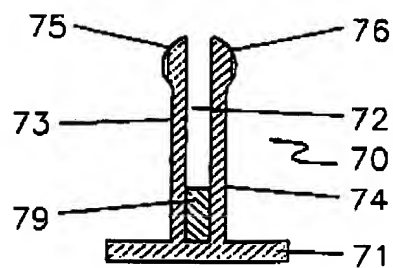


FIGURE 29

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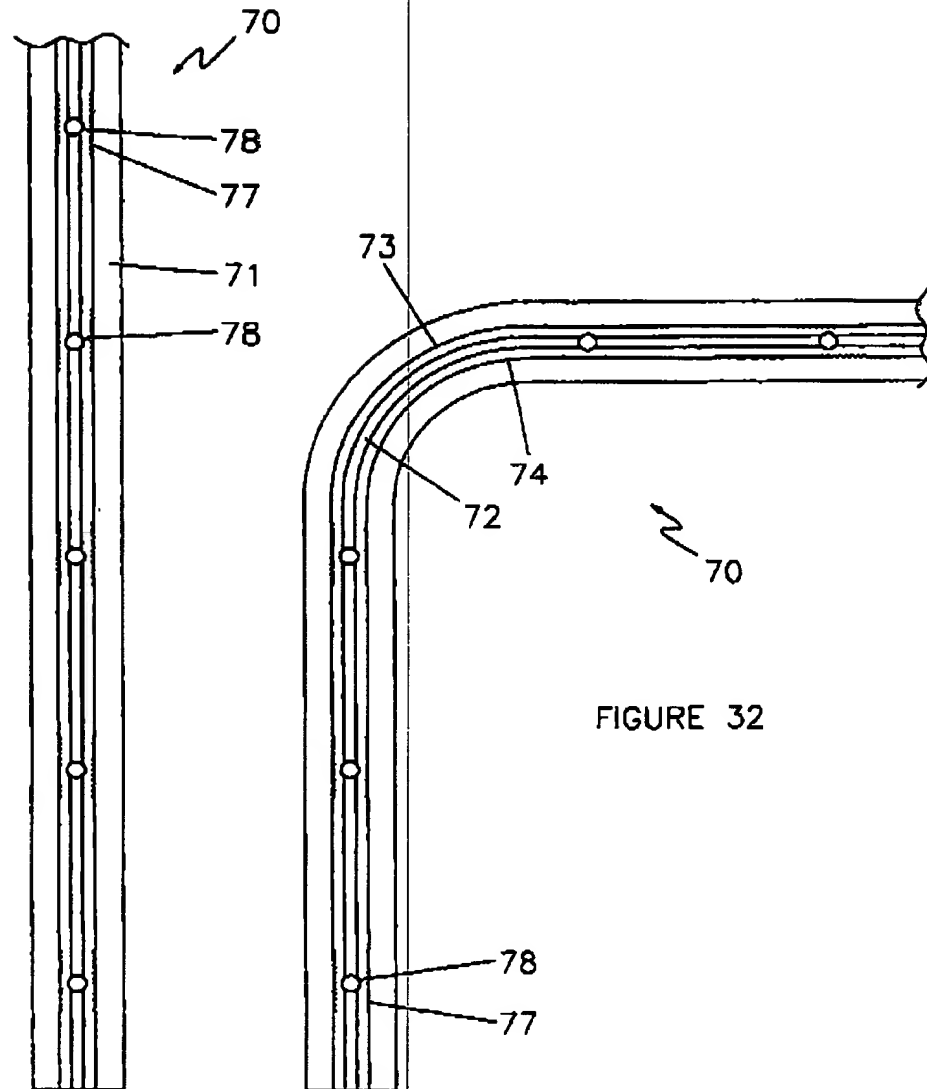


FIGURE 31

FIGURE 32

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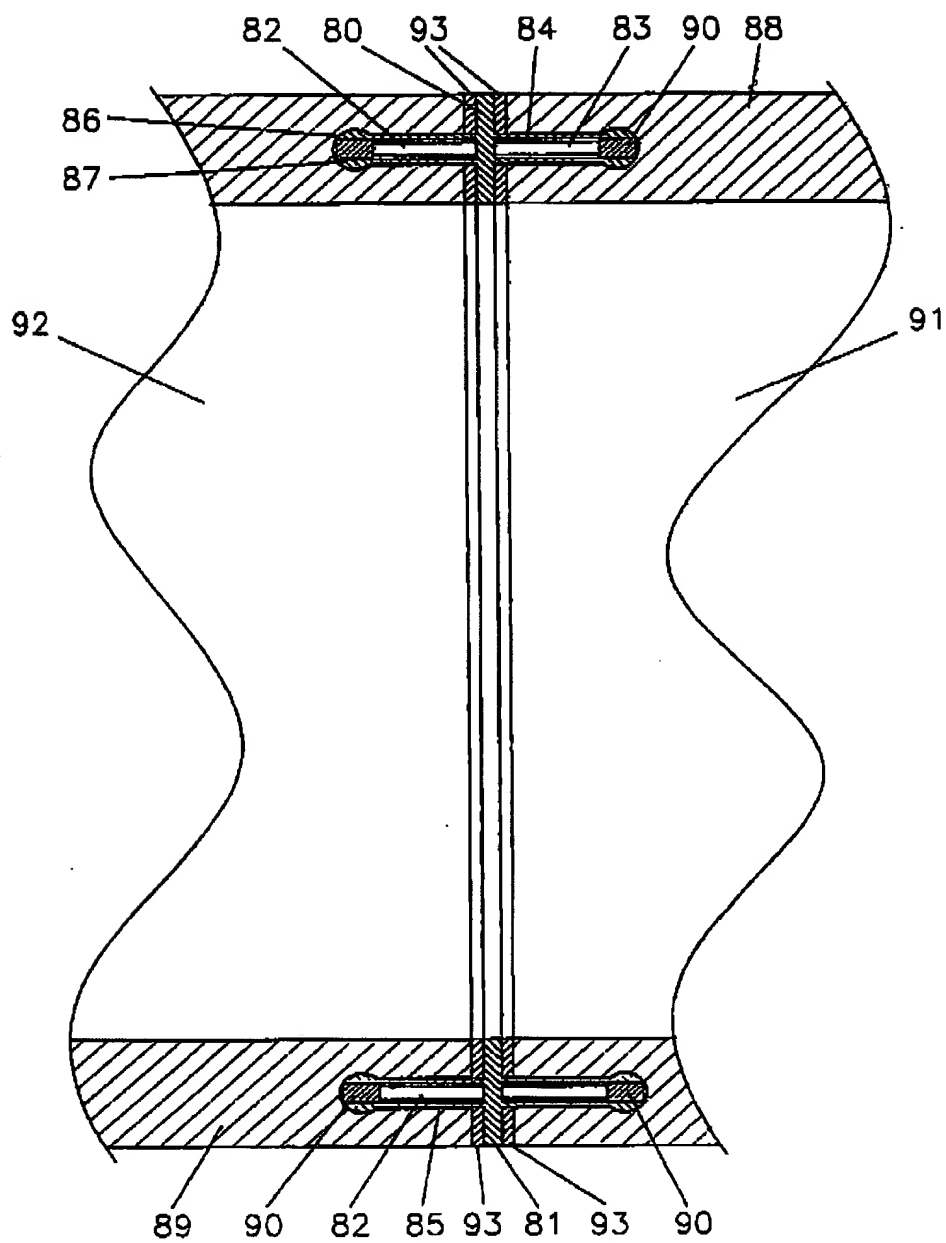
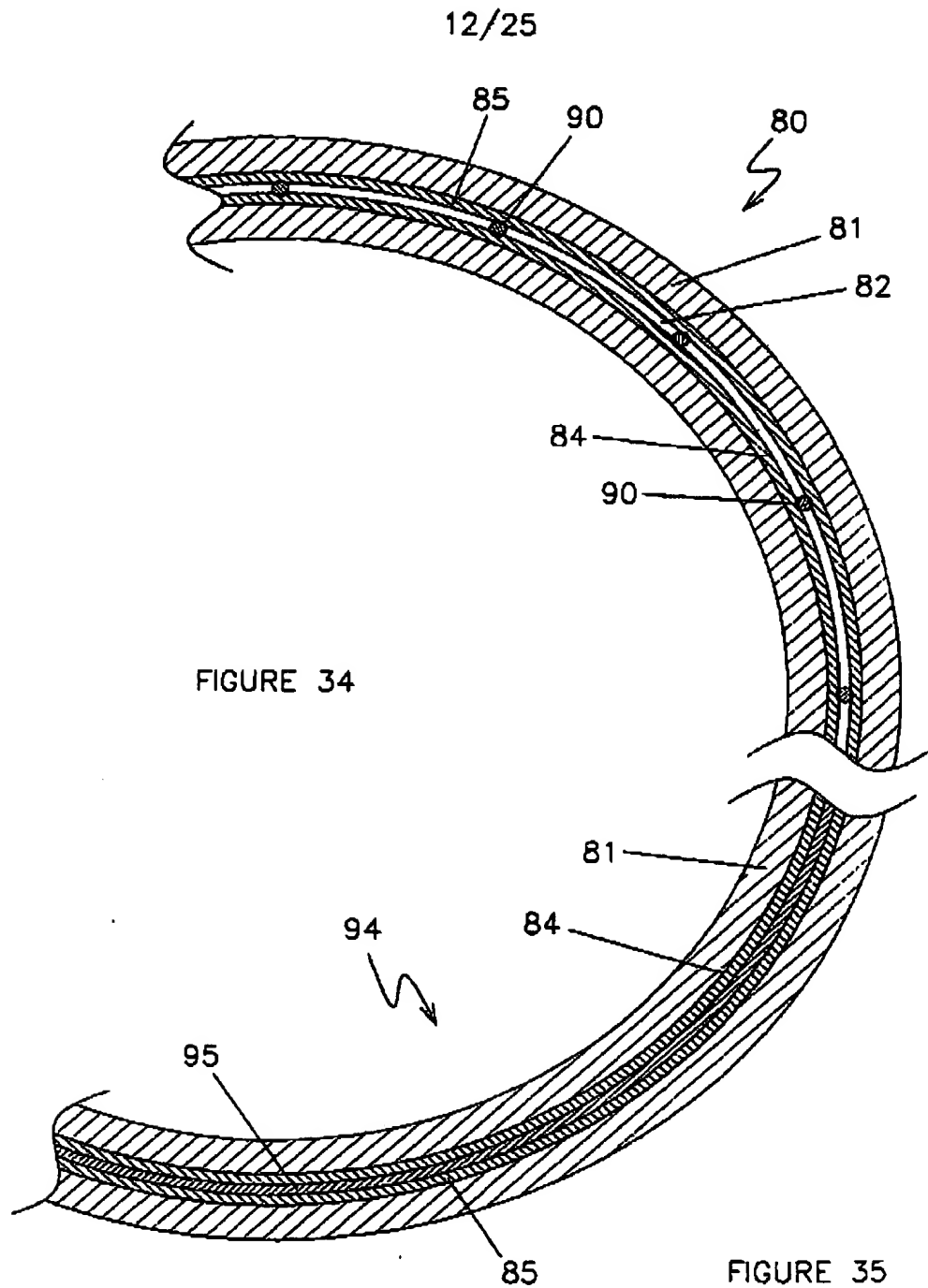


FIGURE 33



Substitute Sheet
(Rule 26) RO/AU

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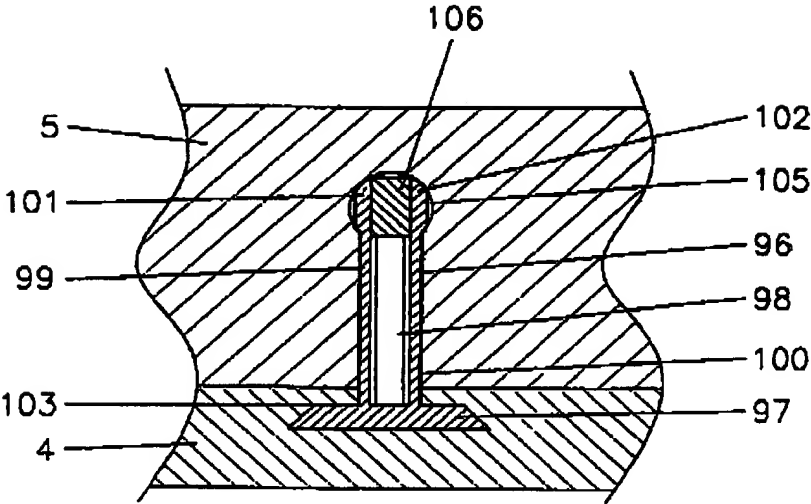


FIGURE 36

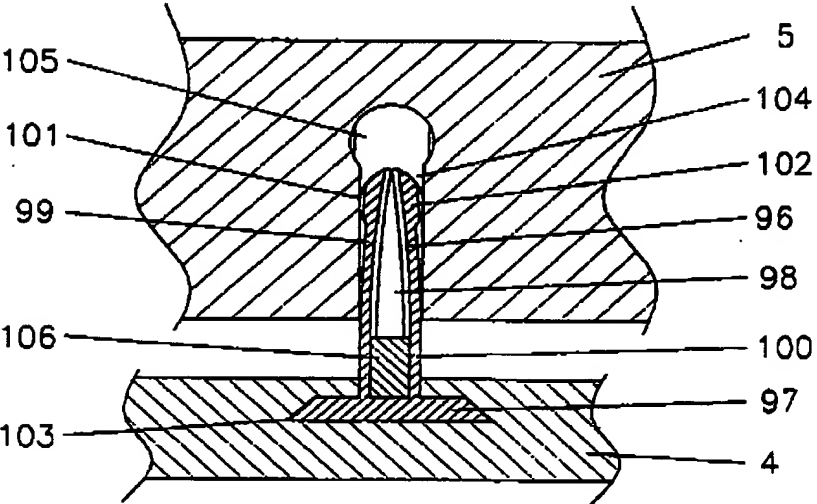


FIGURE 37

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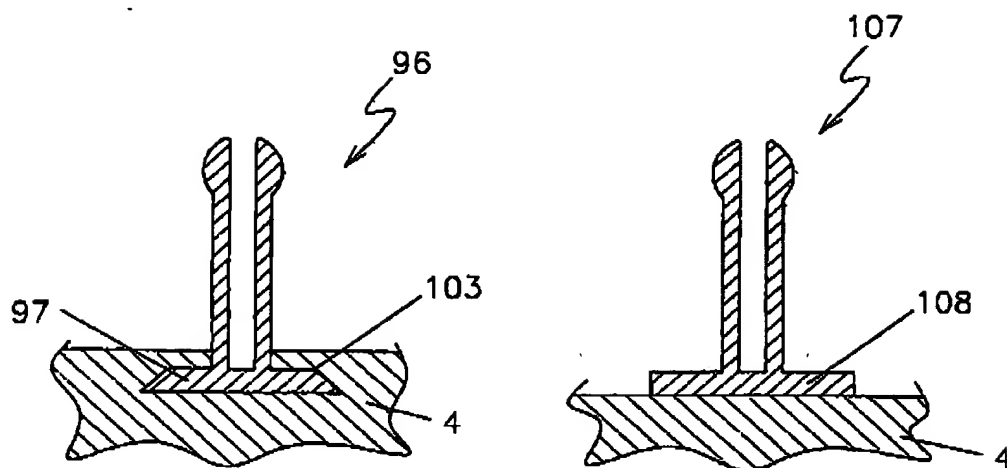


FIGURE 38

FIGURE 39

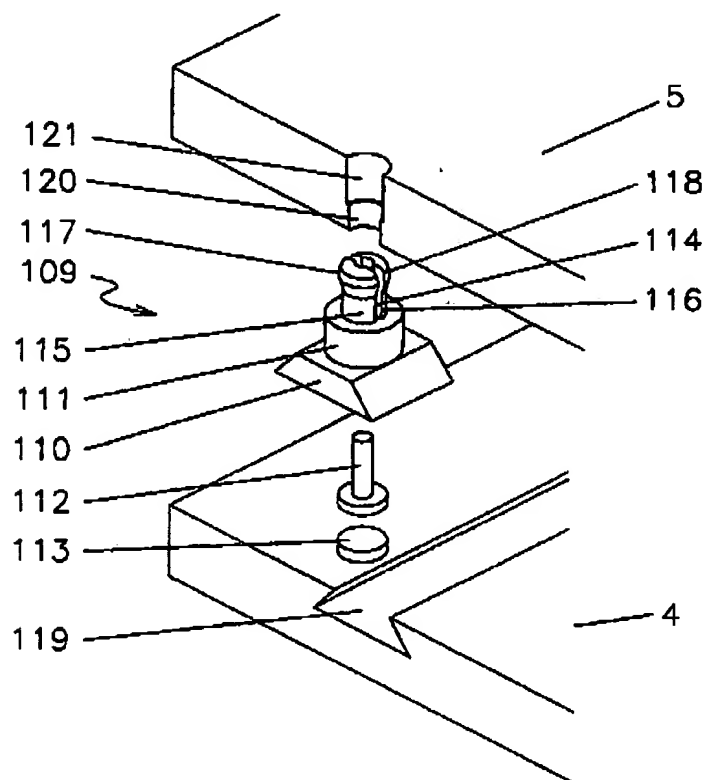
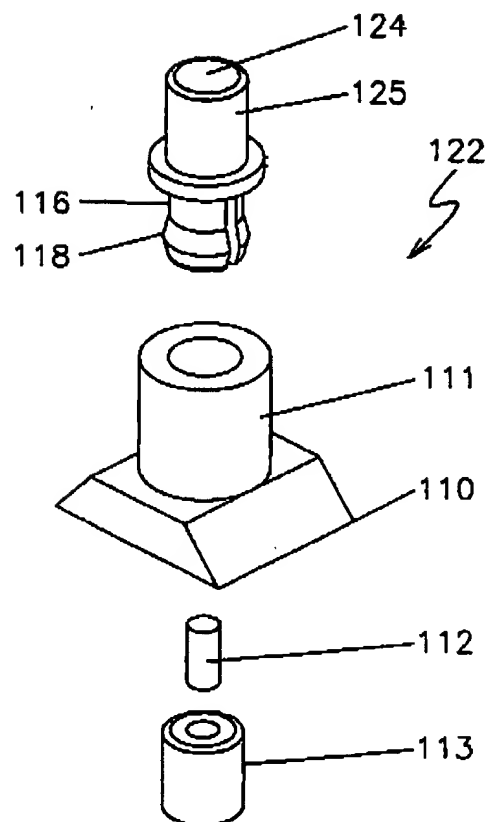
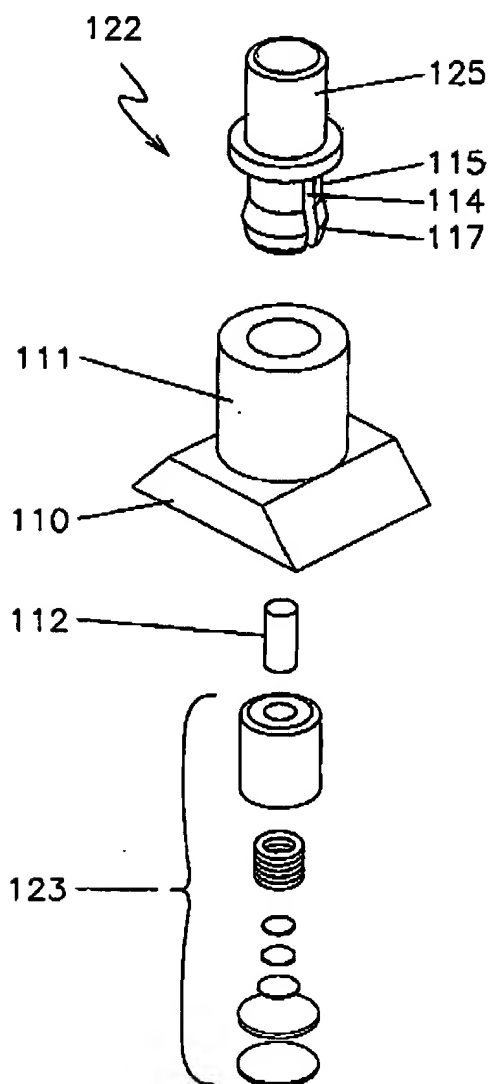


FIGURE 40

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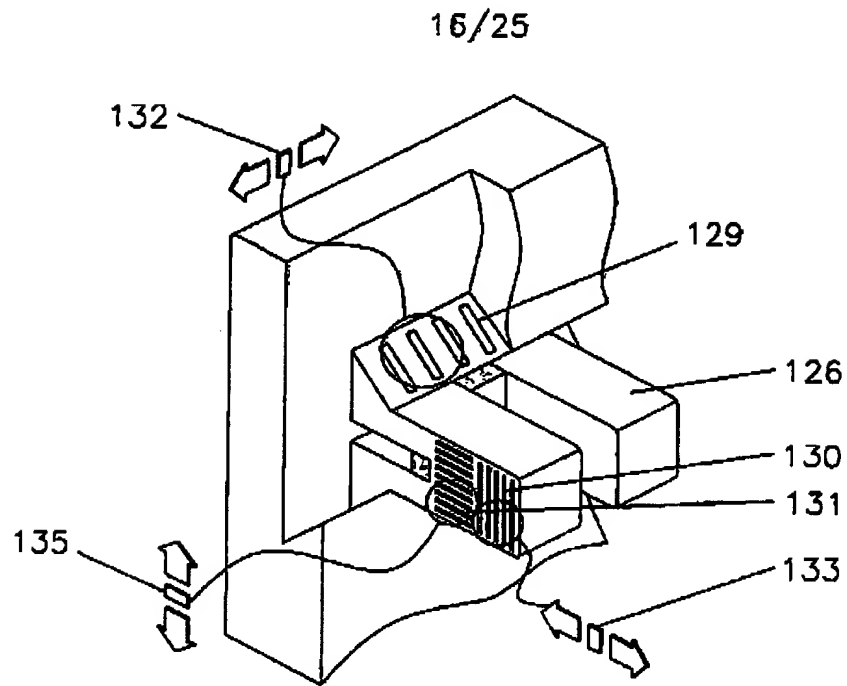


FIGURE 43

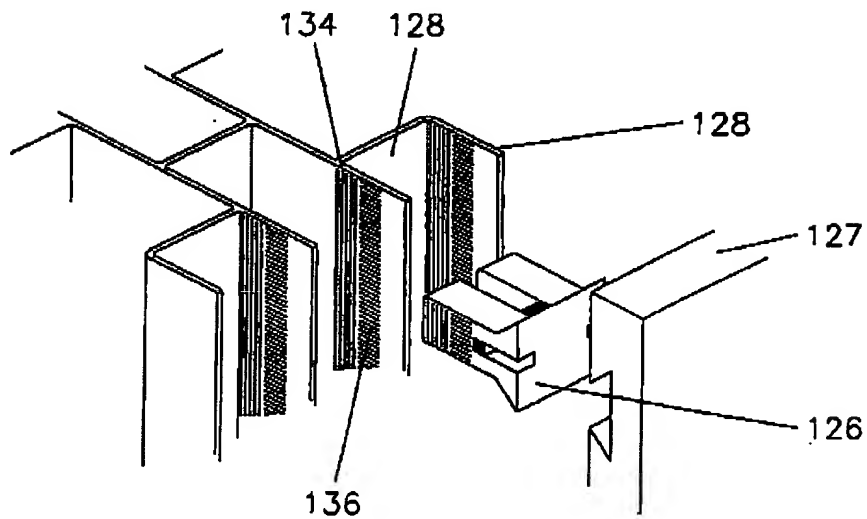


FIGURE 44

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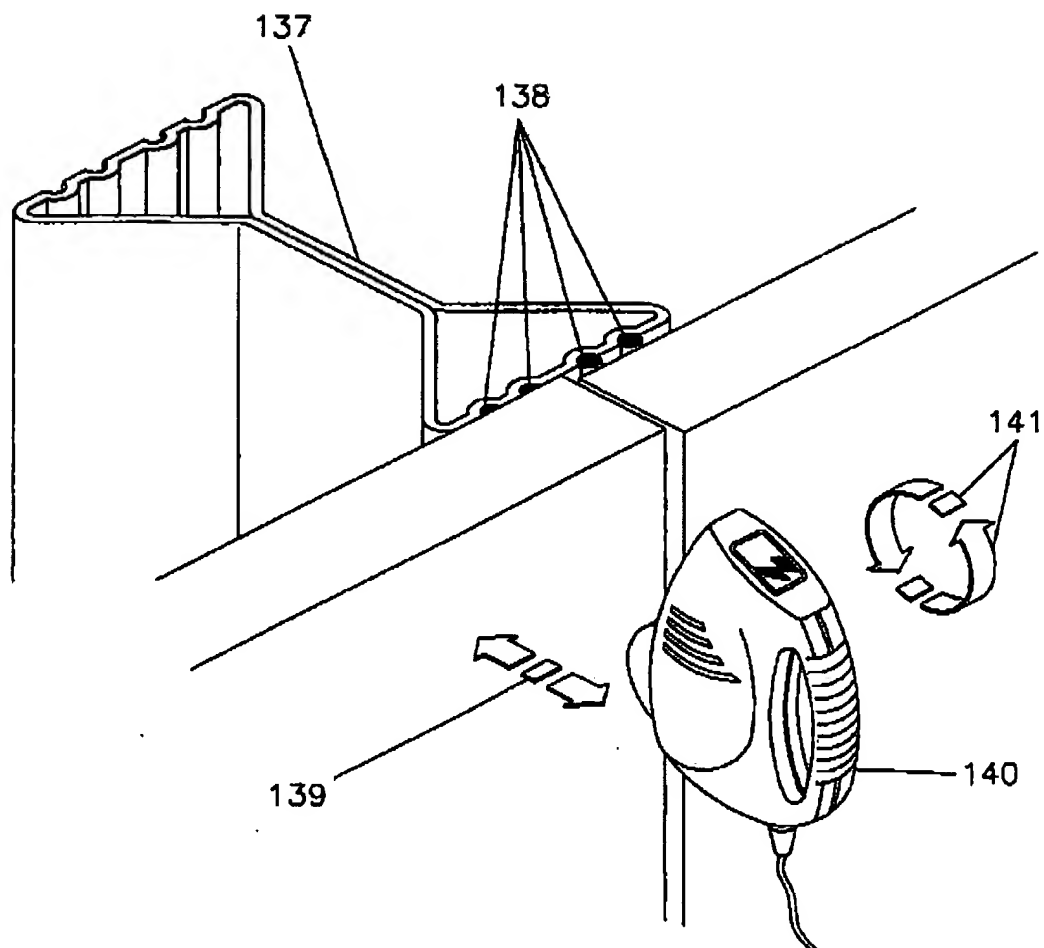
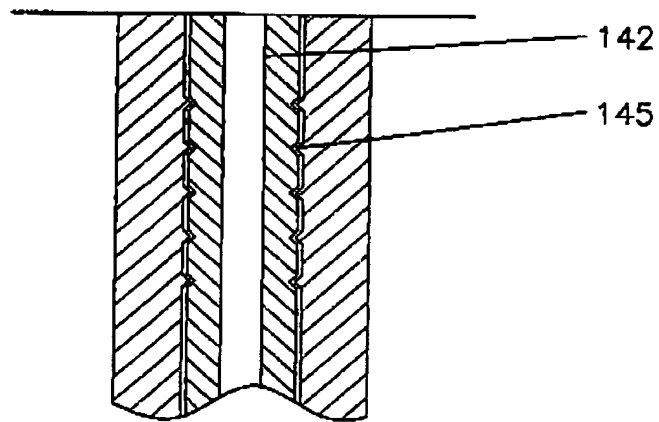
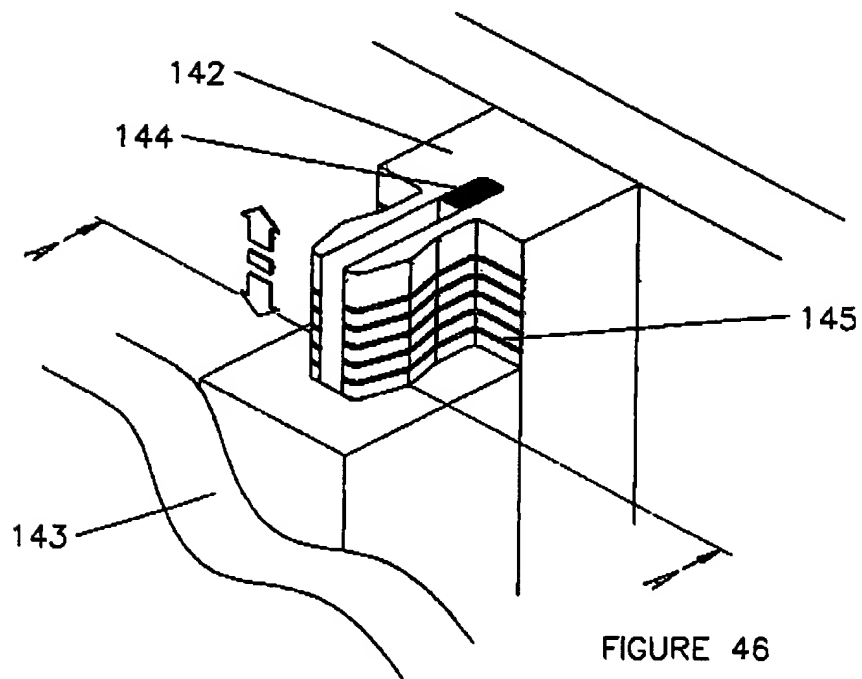


FIGURE 45

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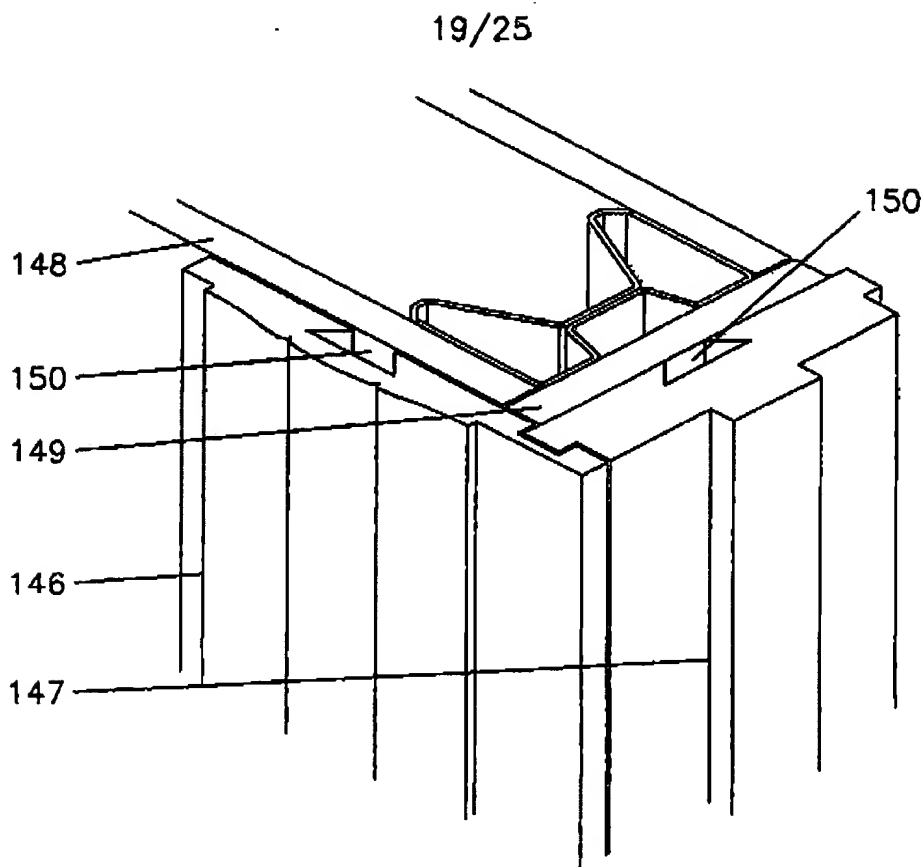


FIGURE 48

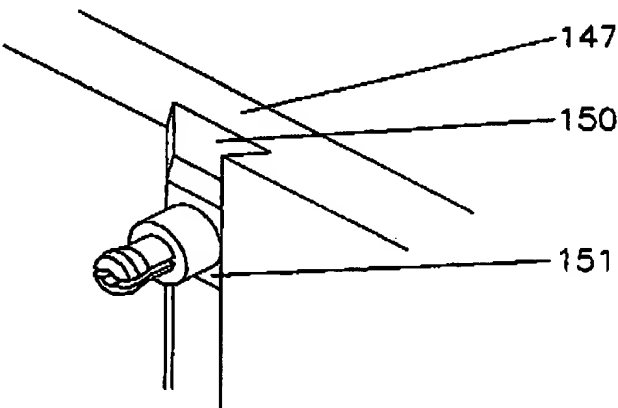
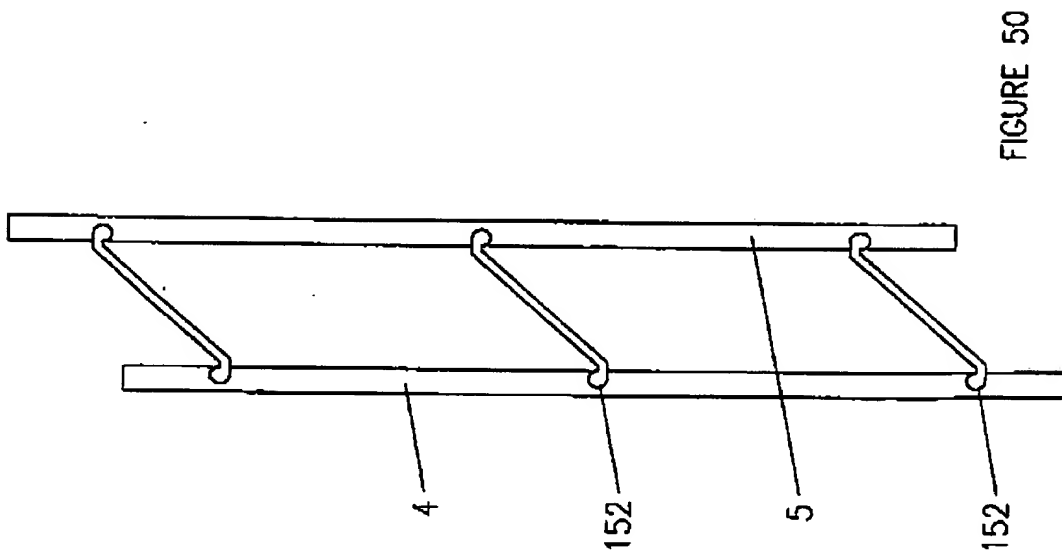
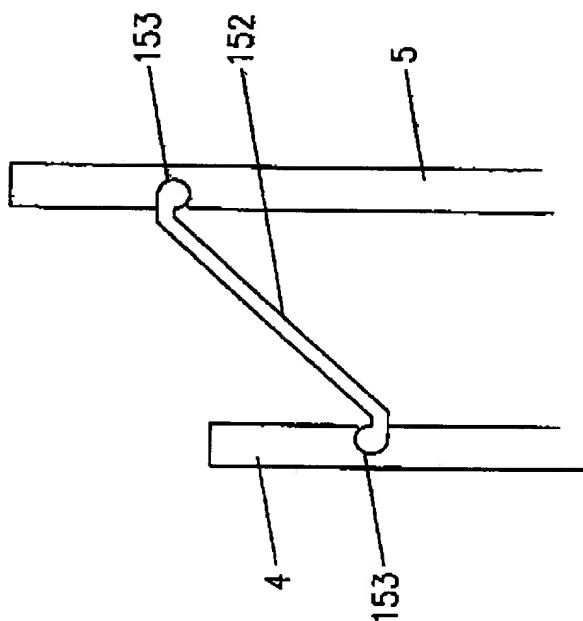


FIGURE 49

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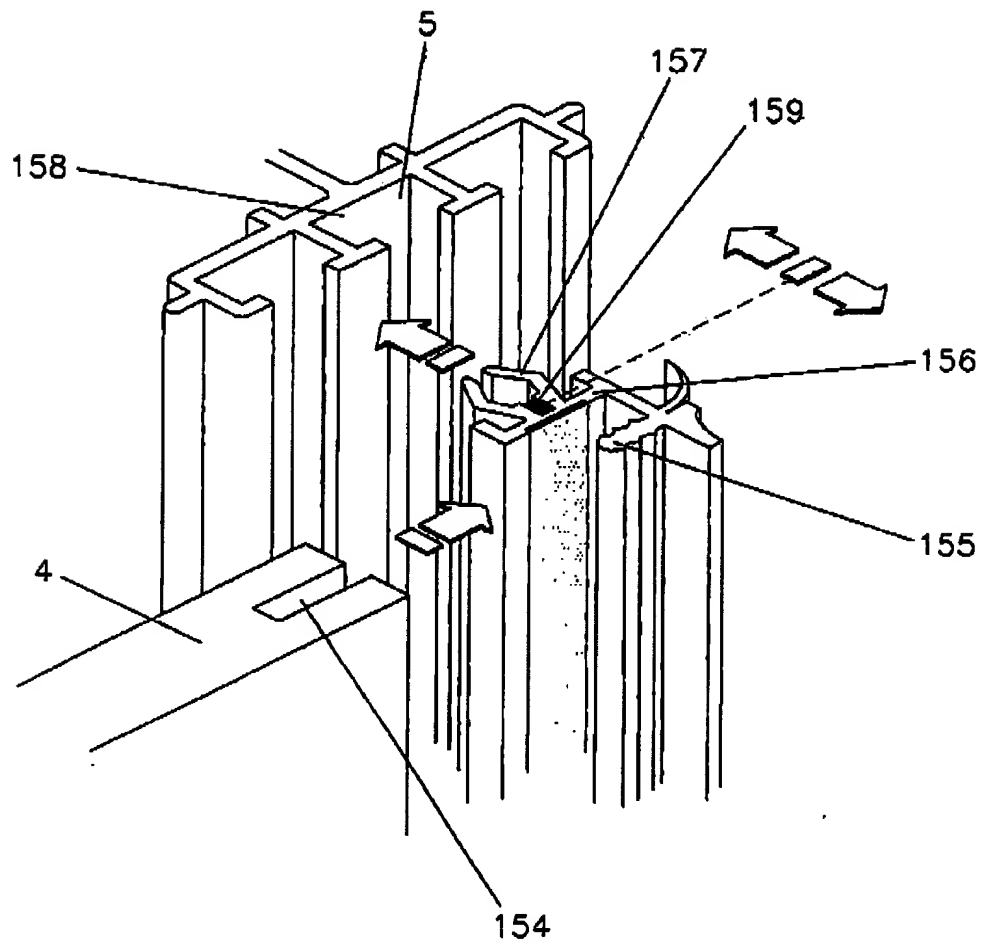


FIGURE 52

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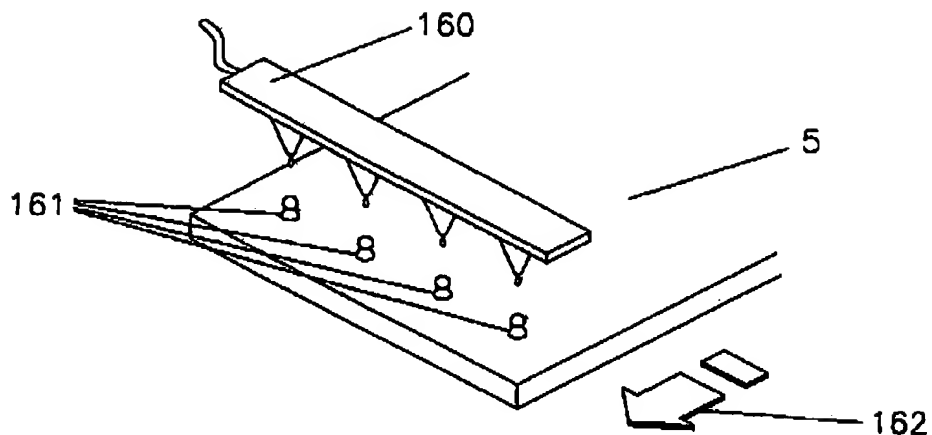


FIGURE 53

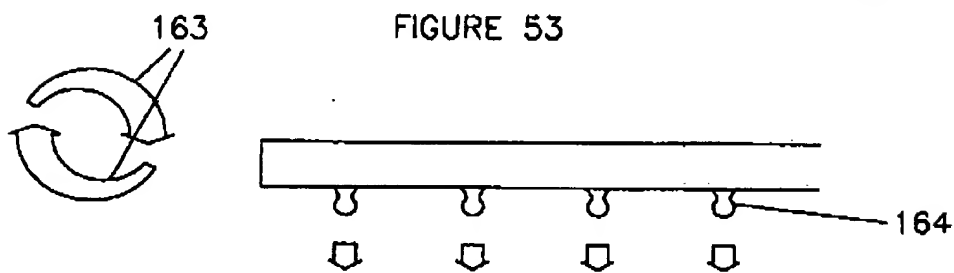


FIGURE 54

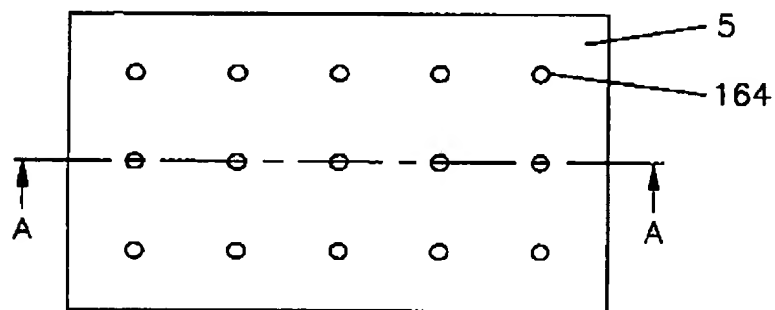


FIGURE 55

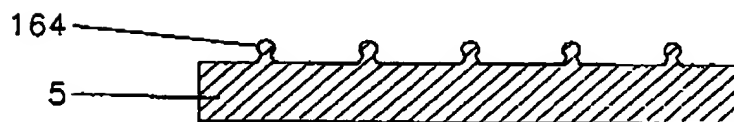
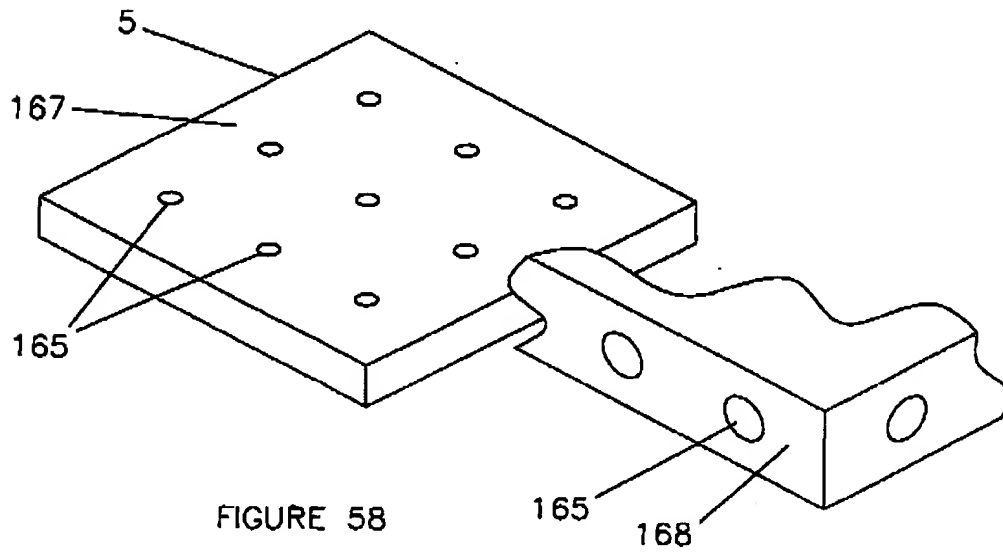
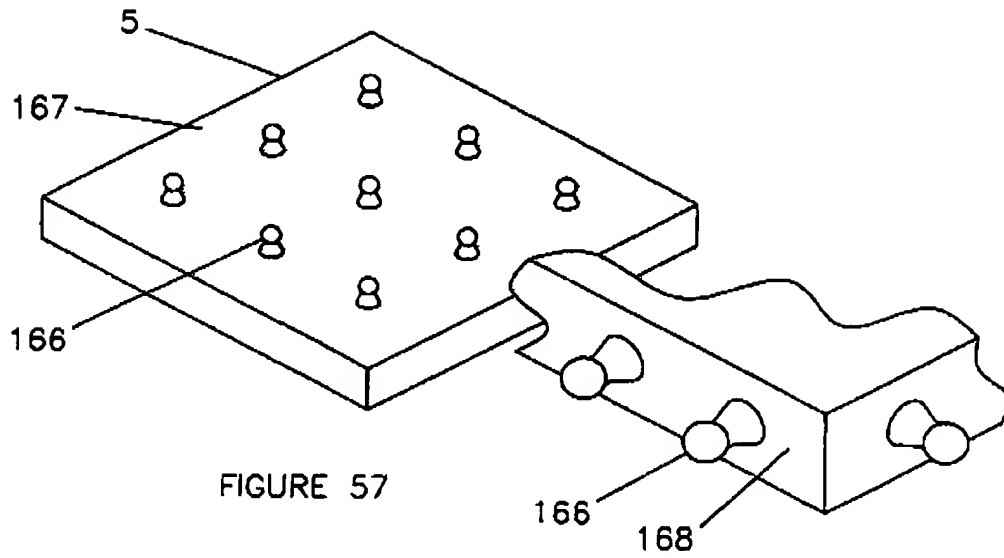
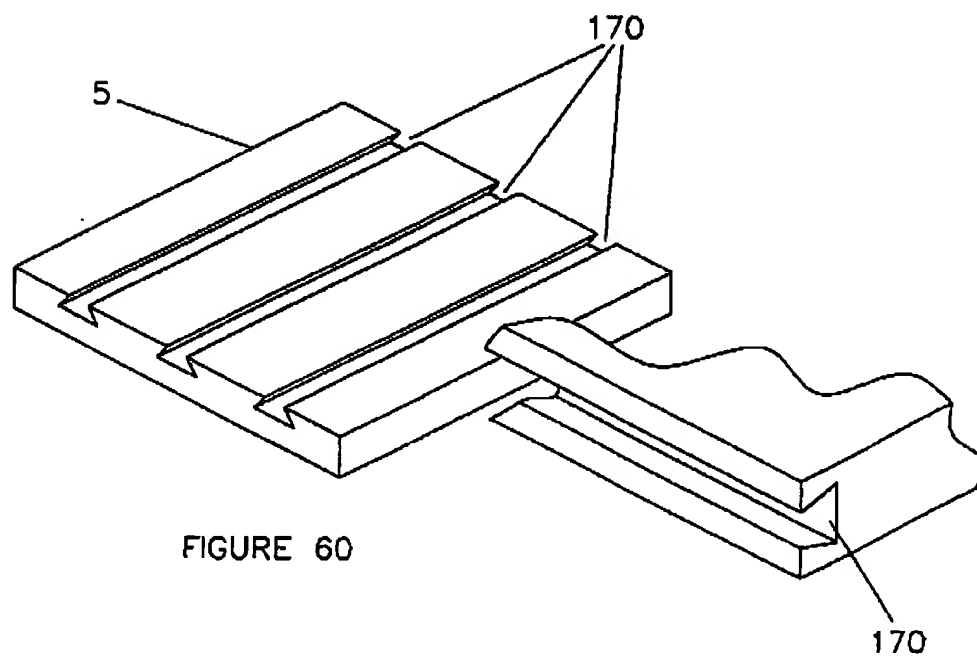
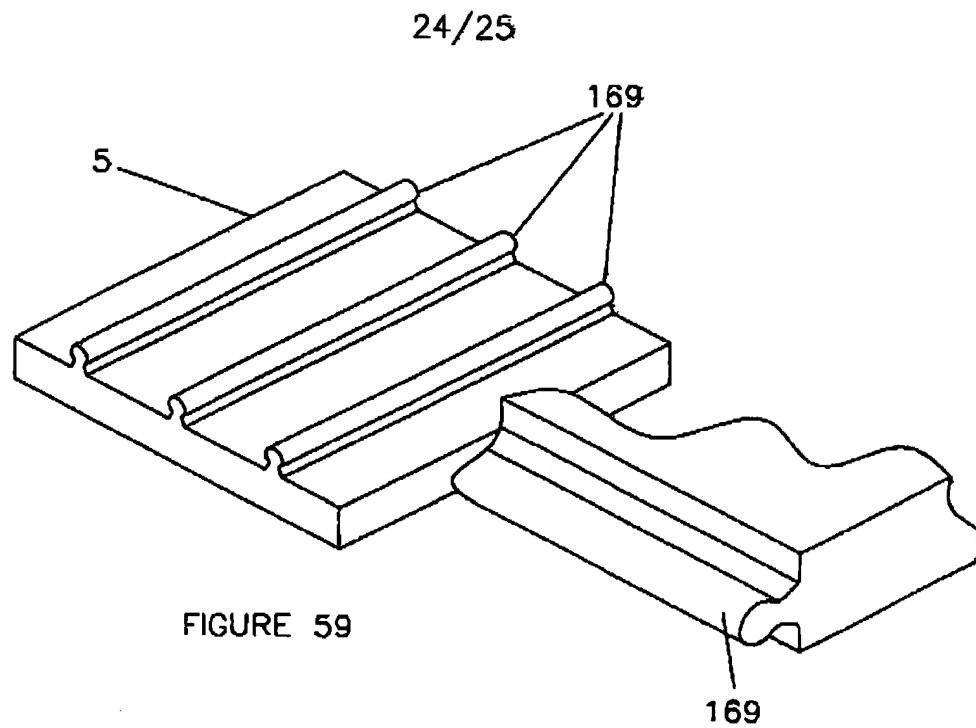


FIGURE 56

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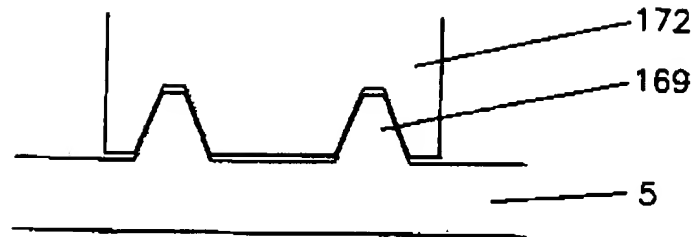


FIGURE 61

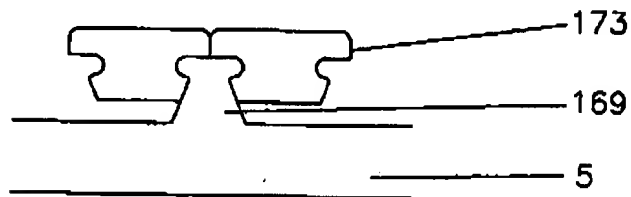


FIGURE 62

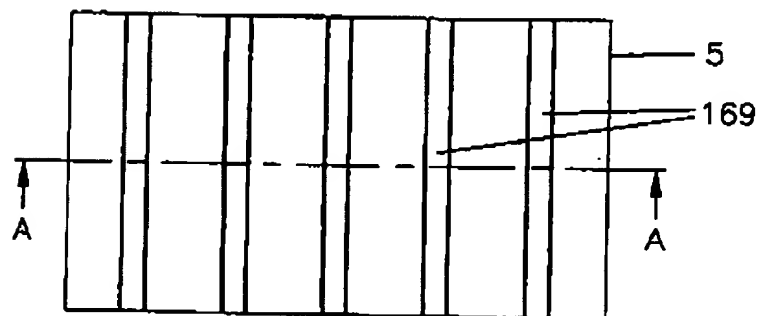


FIGURE 63

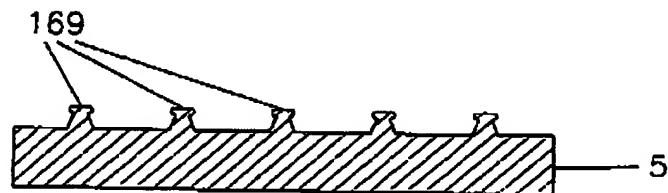


FIGURE 64

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